MARCH, 1954

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

TITANIUM . . .
the Metal of 1954
—Abrasive Action in
Titanium—
Welding of Titanium

•

TV in INDUSTRY
What Can it Do for You?
Here's What It Does for Others!

•

CARBIDE TOOL SUCCESS
Depends Upon Shank Material

•

How About
Fabricating the Zinc
Coated Steels?

•

Transfer Press Tooling
for a
Lamp Body

•

Hardness Testing
Equipment and Methods

•

NEWS OF
People, Products,
Plants and Processes

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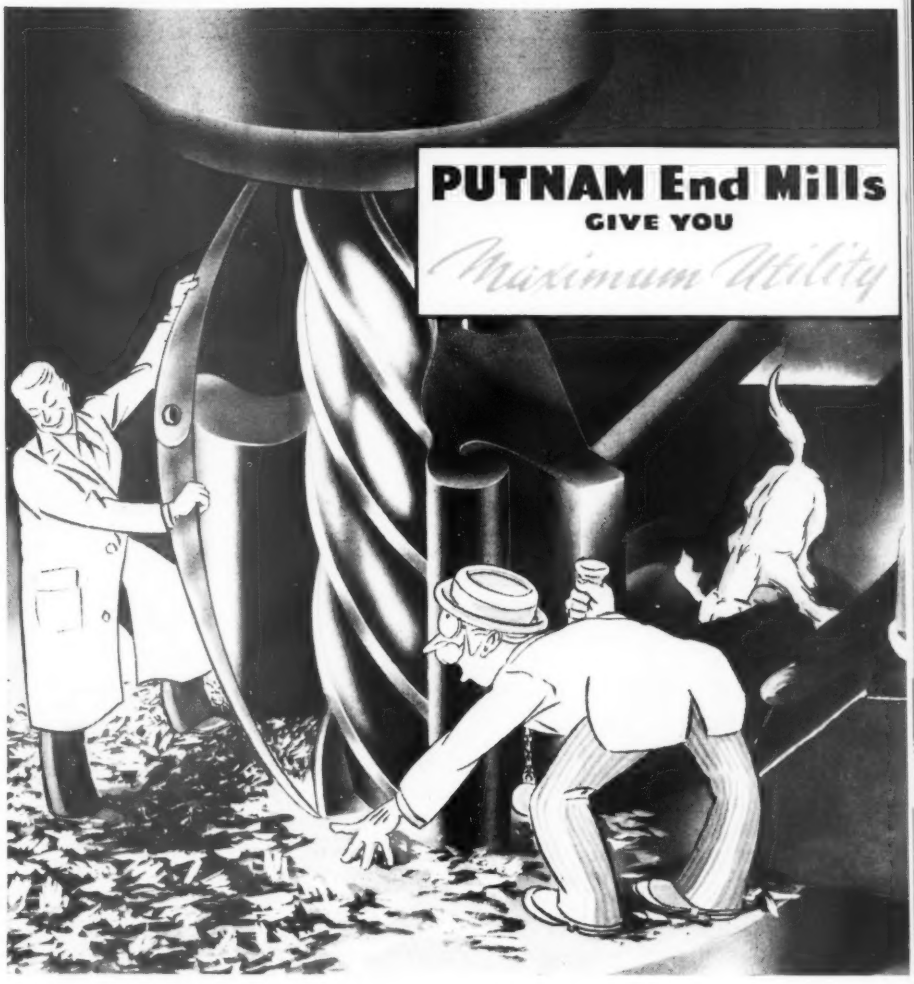
BPA



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through effective cutting over full flute length. It's another Putnam feature that insures faster cutting, longer life. Over 1000 standard types and sizes available. See your Putnam distributor.

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INDUSTRIAL DIAMONDS

MULTI-DIAMOND TOOLS

"Sell it and make your fortune Mynheer Van Niekirk"

It was the year 1876. Free America was 100 years old and there were great celebrations in Philadelphia. In London, Queen Victoria was proclaimed Empress of India.

In South Africa, children playing by the Orange River found a bright pebble, too pretty to throw away, but when trader Van Niekirk offered to buy it they shouted with laughter and told him to sell it and make his fortune.

But, nobody wanted to buy the pebble so Van Niekirk dropped it in an envelope and mailed it to a government agent who declared it to be a diamond of 21 carats. Then, the governor of the Colony bought it for five hundred pounds and sent it to the Paris Exhibition as a curiosity.

Nobody paid much attention, but this was the first clue to the existence of the diamond fields that would one day pour out fabulous treasures in gems—and in industrial diamonds, those incomparable cutting points which do so much to increase production and reduce costs.

The diamond fields are but 75 years old, and for 43 of those years we have specialized in importing and selling industrial diamonds and manufacturing industrial diamond tools—engineered to your job and guaranteed to do it. Please write for our catalogs.

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33 West Street, Bloomfield, N. J.

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A drill press makes money only when the tool is cutting. Each second the spindle stands idle is a dead load on overhead.

Unfortunately, actual machining time in drilling, tapping, reaming or counterboring is pretty well fixed by the nature of the tool and material.

But the time taken in getting the tool to and from the material and the material to and from the tool is pretty much up to the ingenuity of the tool engineer. It's here that costs can be cut — added profits made.

It's here that two Bellows "Controlled-Air-Power" Devices can fit into your picture: The Bellows Drill Press Feed and the Bellows Rotary Work Feeder. The Bellows Drill Press Feed attaches to the star wheel shaft of any standard drill press. A touch on the operating lever and the Feed advances the quill rapidly to the work, feeds the tool under hydraulic control through the work — and returns the quill quickly to starting position. The Bellows Rotary Work Feeder feeds the parts swiftly, accurately and safely to the tool. All the operator has to do is load and unload — the rest is automatic.

Cost reductions can be almost fantastic. In our files are hundreds of case histories telling of savings ranging anywhere from 30% to 80%.

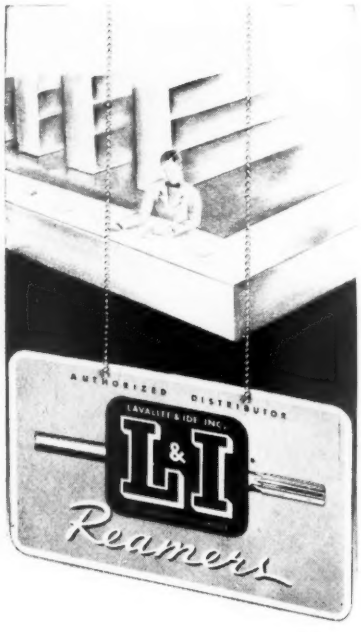
Phone your Bellows Field Engineer. He's listed in your phone book under "The Bellows Co". (In Canada, under Bellows Pneumatic Devices of Canada, Ltd.) Ask him to show you the case history evidence. Or write The Bellows Co. Dept. BW-154 Akron, Ohio for Bulletins TP354 and T85.

The Bellows Co.
ESTABLISHED 1911
AKRON 9, OHIO

871-A

CONTROLLED-AIR-POWER FOR FASTER, SAFER, BETTER PRODUCTION

CIRCLE INFORM-A-GRAM KEY NO. 3



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is your guarantee of top performance ..in a reamer ...in a distributor.

L&I *The Reamer Specialists*

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CIRCLE INFORM-A-GRAM KEY NO. 4

TOOLING and PRODUCTION

The Magazine of Manufacturing Management

formerly
Tool-Die-Machine PROGRESS 1934-1941
TOOL & DIE JOURNAL 1941-51

Vol. XIX—No. 12 March, 1954

CONTENTS

Editorial 37
Editorial Index 38
Shop Aids 70
Publication Previews 94
Men You Should Know 102
Quick Pic 127
Inform-A-Gram Card 131
Progress On Parade 135

EDITORIAL STAFF

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They have the influence that enables them to adopt the ideas and the processes which TOOLING and PRODUCTION describes in every issue AND the authority to recommend, to specify and/or to buy everything that may be needed to reduce costs, increase production or improve quality. These men for whom, each month, our editors seek out or write TOOLING and PRODUCTION'S meticulously accurate stories of "Know-How" and "Tell-How" are T & P's exclusive Cycle of Buying Influence (CBI) in their plants.

Every copy is directed to these men by name, by title and by company address. Please see our CCA verification.

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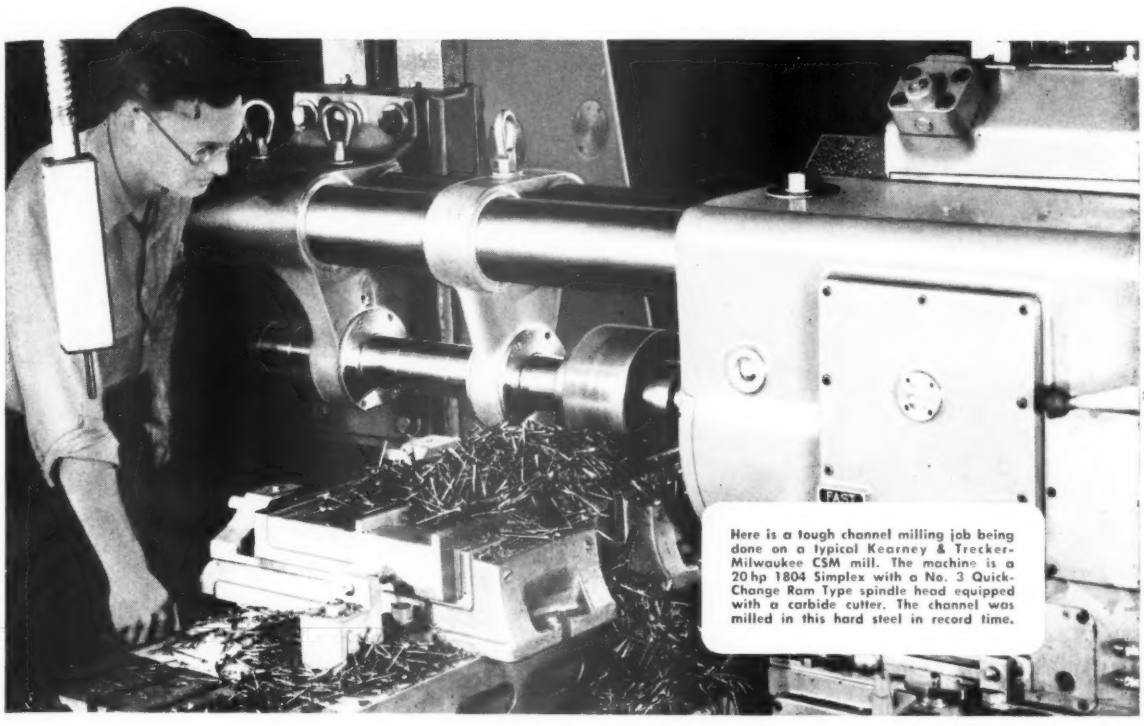


Here is a tough channel milling job being done on a typical Kearney & Trecker-Milwaukee CSM mill. The machine is a 20 hp 1804 Simplex with a No. 3 Quick-Change Ram Type spindle head equipped with a carbide cutter. The channel was milled in this hard steel in record time.

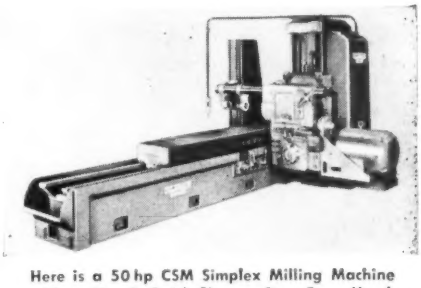
Put your milling on a profitable production basis...

Choose a CSM production mill from over 400 available combinations!

FOR more efficient metalworking, investigate the most modern and useful line of bed-type milling machines ever designed. Custom-built from standard units, CSM machines are available in 10 to 50 hp, Simplex and Duplex models with a choice of quill type or ram type heads. Tables are available in four standard widths — 18, 24, 32 and 42″ — with travels from 4 to 12′. Rapid traverse rate is 150″ per min., and 32 feed rates range from ¼ to 60″ per min. You can choose from a wide range of attachments and accessories to meet your exact tooling needs.

Your Kearney & Trecker Special Machinery representative will be pleased to give you all the details . . . help analyze your machine tool requirements.

Capacity . . . Experience . . . Performance— In our just completed $5,200,000 expansion of our Special Machinery Division, we offer you (1) unmatched facilities, (2) experience based upon more than 50 years in the design and production of special machinery, and (3) performance, best recommended by our outstanding record of successfully solving many hundreds of unusual machining problems.



Here is a 50 hp CSM Simplex Milling Machine with a No. 5 Quick-Change Ram Type Head.

Our complete line of CSM milling machines is described and illustrated in detail in this big 20-page catalog. For your copy write to Kearney & Trecker Corp., Special Machinery Division, 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER CORP. · *Special Machinery Division*
MILWAUKEE 14, WIS., U. S. A.

CIRCLE INFORM-A-GRAM KEY NO. 5

CINCINNATI accurately shears

1/2" plate... and 20 gauge sheets

...without changing knife clearance

... You do not change knife clearance for successful shearing of different thicknesses on a Cincinnati. Just set the clearance for the thinnest material and shear all thicknesses up to capacity. Thousands of Cincinnati Shears are used continuously in this manner. This practical method prevents accidental damage—saves time. Remember, changing knife clearance interrupts production.

Sharp knives are a necessity for satisfactory shearing, especially on very light gauges. Remember changing knife clearance does not sharpen dull knives. We suggest you write for data sheet on knife life.

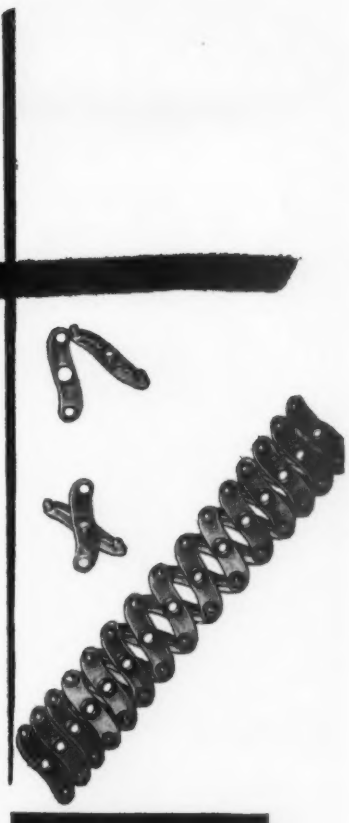
Write for Catalog S-6... describing Cincinnati Shears

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

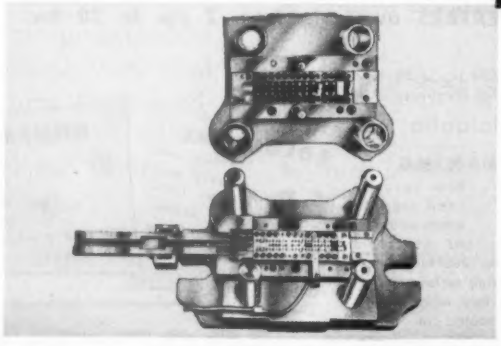
BENRUS OBTAINS "WATCHMAKER'S PRECISION" STAMPING with PRODUCTO *Catalog* DIE SETS



Economy, at no sacrifice of production speed or quality, is the keynote of this Producto case history, which shows how the Benrus Watch Co., Inc., Waterbury, Connecticut, cut their stamping costs in the production of wrist watch "X-type" expansion bracelets. The secret, according to Benrus, lay in converting a Producto 2-pin catalog die set into a 4-pin die set suitable for this precise link stamping job. The conversion, which was quickly and easily made, gave Benrus a small, compact, and carefully balanced die set that lined up properly and permitted a unilateral load and vertical punch, with no problem of "winking." As a result, Benrus has been able to maintain consistently high-quality, high-speed stamping with extremely low per-hour and per-grind costs. Rejects have been reduced to an absolute minimum. The specifications below tell the complete story.

PART: "X-type" Expansion Bracelet.
STAMPINGS: Top and bottom links (or liner parts) supporting outer shells.
MATERIALS — TOP LINK: Type 430 steel, dead soft, bright finish.
BOTTOM LINK: 85-15 rich low brass, dead soft.
TOLERANCE: Hole Locations — Both top and bottom ± .0005".
THICKNESS: Top — .018" Bottom — 030".
STATIONS: Top — 3. Bottom — 10.
PRODUCTION: Top — 6,000 pieces per hour. 50,000 pieces per grind.
Bottom — 6,000 pieces per hour. 75,000 pieces per grind.
OPERATIONS: Top — Pierce, pilot, blank.
Bottom — 6 draws, pierce, swedge, pilot, blank.

This special watchmaker die set, made by Producto to Benrus specifications, was used for stamping top links.



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BOOTH #722
ASTE 1954 INDUSTRIAL EXPOSITION
PHILADELPHIA
April 26-30 Incl.

For Precision Die Sets *Fast* Call...

THE PRODUCTO MACHINE CO. 970 Housatonic Ave., Bridgeport 1, Conn.
ALSO MAKERS OF TOOL AND DIEMAKERS ACCESSORIES, VISES, MACHINERY

PRODUCTO

1PD84A
1PD84B

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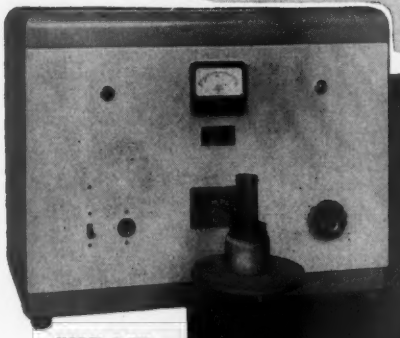
Lepel's 3 new

LOW COST - PORTABLE HIGH FREQUENCY *Induction* HEATING UNITS

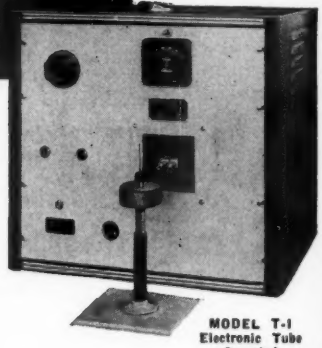


MODEL 2 KW Spark Gap Operated
$870.
f.o.b. factory

MODEL T-2½-1 Electronic Tube Operated
$1620.
f.o.b. factory

Ideal for

- Production Heating of small parts
- Research Laboratories
- Tool Rooms
- Machine Shops
- Educational Institutions



MODEL T-1 Electronic Tube Operated
$885.
f.o.b. factory

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of pioneering electrical and metallurgical experience, the name Lepel has become the symbol of induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

Amazing in its speed, Lepel equipment reduces the time required for hardening, annealing, stress relieving, brazing, soldering and melting from minutes to seconds. It performs these operations with a degree of precision and uniformity rarely attained through other processes.

LEPEL Electronic Tube GENERATORS available from 1 kw to 100 kw.
LEPEL Spark Gap CONVERTERS available from 2 kw to 30 kw.

WRITE FOR THE NEW LEPEL CATALOG . . . 36 illustrated pages packed with valuable information on high frequency induction heating.

BRAZING Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

HARDENING Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.

SOLDERING Speedily and neatly performs intricate soldering applications with or without the use of preformed rings.

ANNEALING Ideal for annealing, stress-relieving, normalizing or pre-heating selected areas.

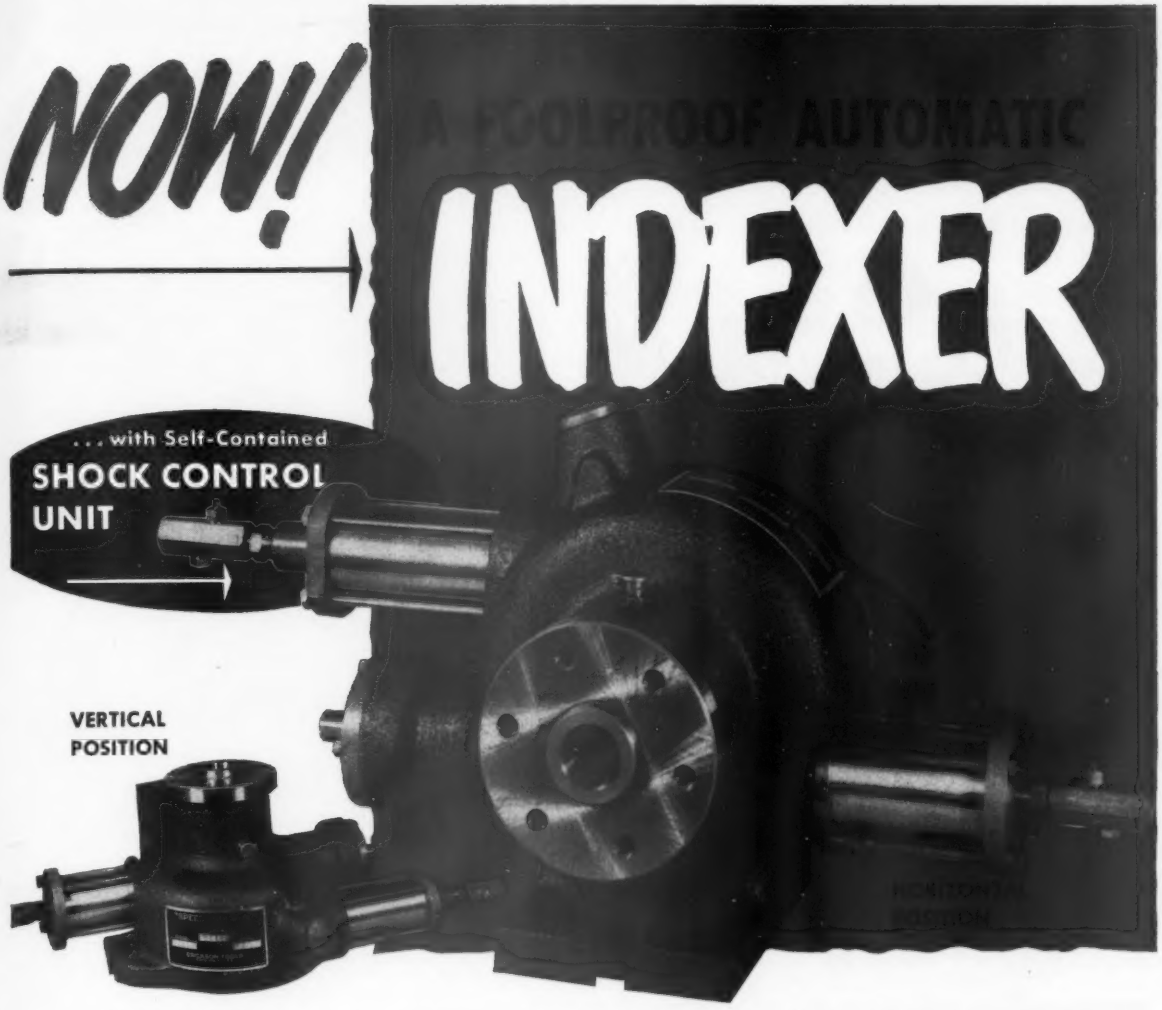
MELTING Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.

All Lepel equipment is certified to comply with the requirements of the Federal Communications Commission.

LEPEL HIGH FREQUENCY LABORATORIES, INC.
55th STREET and 37th AVENUE, WOODSIDE 77, NEW YORK CITY, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 8

NOW! A FOOLPROOF AUTOMATIC INDEXER



Designed to speed up and simplify accurate positioning, Erickson Speed Indexers are an outstanding demonstration of the modern tool engineer's ingenuity and skill.

Erickson indexers are protected by an integral shock control unit that assures constant, uniform feed . . . adjusts to meet varying loads . . . allows maximum speeds without injury to mechanism or work.

EXCLUSIVE ERICKSON INDEXER FEATURES

- Usable either vertically or horizontally
- Can be operated by air or hydraulics
- Positive lock pin independent of actuating fluid
- Integral shock control unit
- Models adaptable up to 100 positions
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Write for Erickson Catalog Today!

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PRECISION HOLDING TOOLS • COLLET CHUCKS • TAP CHUCKS • AIR CHUCKS & CYLINDERS • EXPANDING MANDRELS • HOLDERS • INDEXERS

See Erickson Tools in Booth 805 at ASTE Show, Philadelphia, April 26 to 30

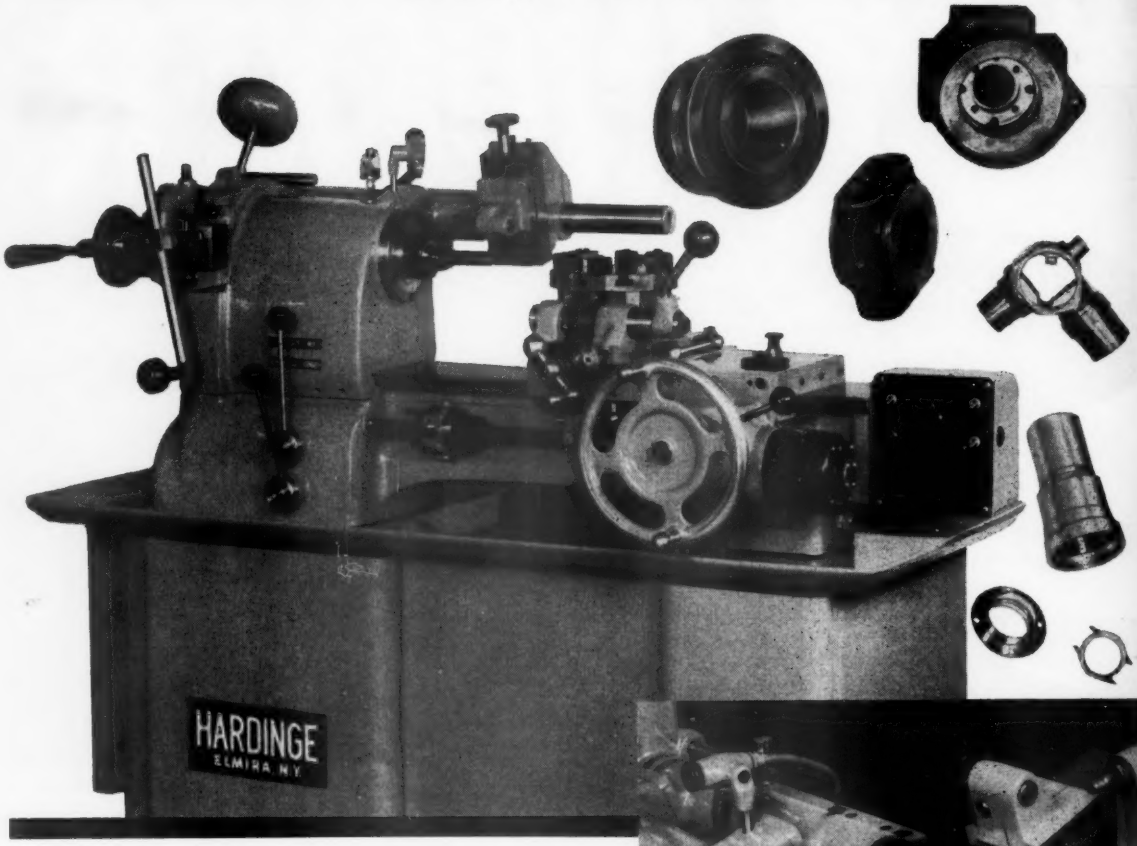
CIRCLE INFORM-A-GRAM KEY NO. 9

HARDINGE
ELMIRA, N.Y.

PRECISION CHUCKING MACHINE

Users say:

"We now get Production with Tool Room Accuracy"



Users enthusiastically tell us how they can easily maintain close tolerances, get better parts finish, and at the same time substantially cut costs . . . when they put Hardinge High Speed Precision Chucking Machines to work.

These results are possible because parts are finished in one setting with simplified tooling. All parts shown were produced with standard tool bits.

1" Collet Capacity—6" Chucking Capacity—Write today for Bulletin HC-HCT which presents the whole story.

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PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE

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CIRCLE INFORM A-GRAM KEY NO. 10

Accurate Die Alignment Reduced Die Maintenance

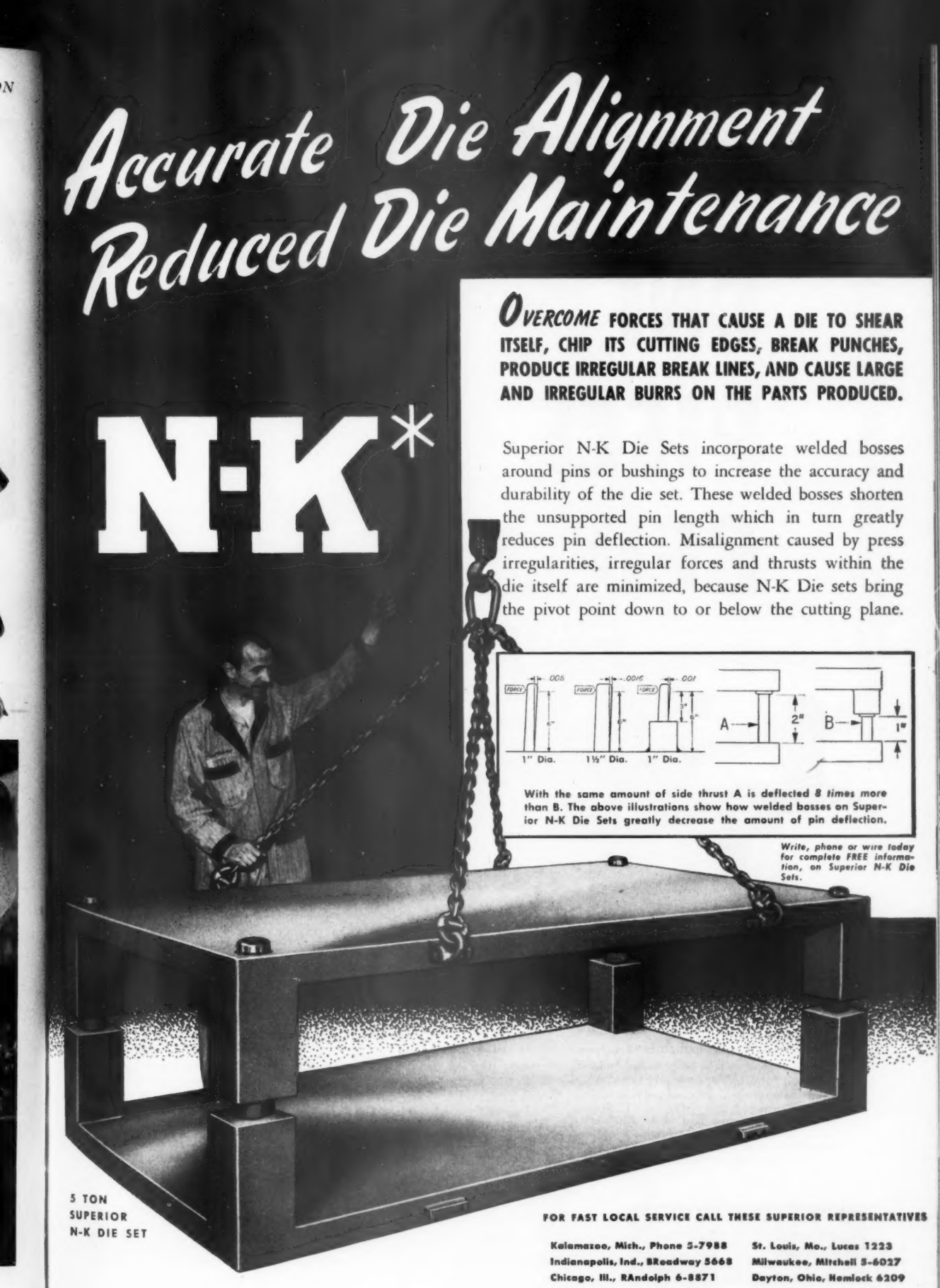
N-K*

OVERCOME FORCES THAT CAUSE A DIE TO SHEAR ITSELF, CHIP ITS CUTTING EDGES, BREAK PUNCHES, PRODUCE IRREGULAR BREAK LINES, AND CAUSE LARGE AND IRREGULAR BURRS ON THE PARTS PRODUCED.

Superior N-K Die Sets incorporate welded bosses around pins or bushings to increase the accuracy and durability of the die set. These welded bosses shorten the unsupported pin length which in turn greatly reduces pin deflection. Misalignment caused by press irregularities, irregular forces and thrusts within the die itself are minimized, because N-K Die sets bring the pivot point down to or below the cutting plane.

With the same amount of side thrust A is deflected *8 times* more than B. The above illustrations show how welded bosses on Superior N-K Die Sets greatly decrease the amount of pin deflection.

Write, phone or wire today for complete FREE information, on Superior N-K Die Sets.



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SUPERIOR
N-K DIE SET

FOR FAST LOCAL SERVICE CALL THESE SUPERIOR REPRESENTATIVES

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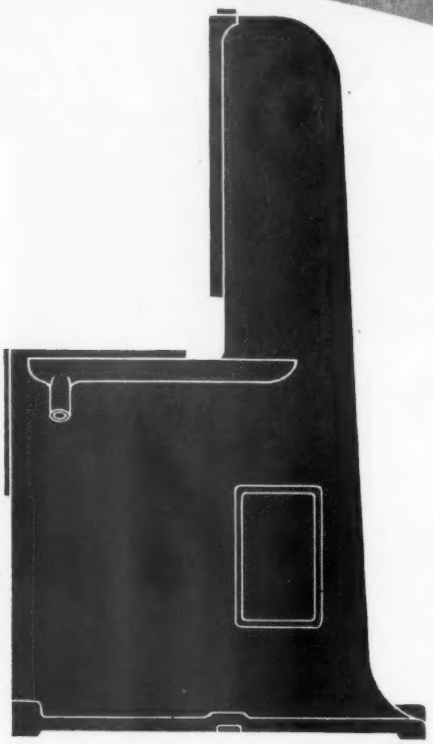
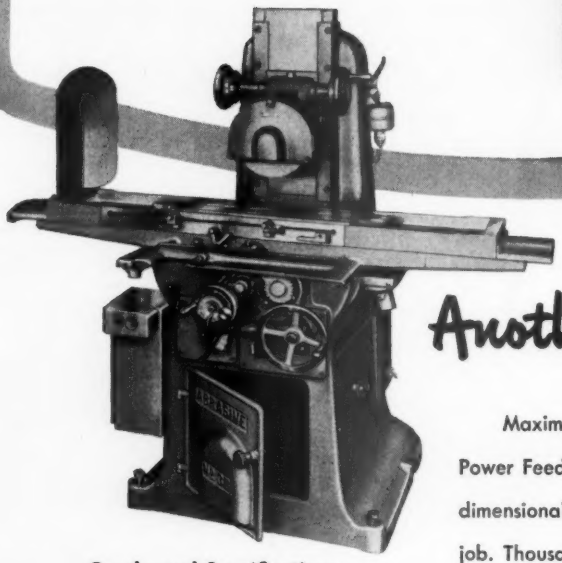
ONE PIECE BED...





Another big plus for the 3-B

Maximum stability — a designed-in feature of Abrasive 3-B Power Feed Surface Grinder — insures perfect alignment, accurate dimensional control, and smooth surface finish on every grinding job. Thousands of these dependable grinders are serving in toolrooms and on production lines . . . producing precision work fast and efficiently. Find out how the Abrasive 3-B can help in your plant . . . write for descriptive catalog. Abrasive Machine Tool Company, 16 Dunellen Road, East Providence 14, Rhode Island.

Condensed Specifications

Type: Horizontal spindle, reciprocating table.
Capacity: 24" long x 8" wide x 12" high.
Feeds: Automatic in longitudinal and transverse directions.
Automatic cross feed (0 to .070" at either or both ends of table travel).
Wheel: Standard Type 1 — 10" diam. driven by 3 HP, 1750 RPM motor.

ABRASIVE
ACCURACY BOOSTS PRODUCTION

Abrasive Quality Is Reflected in the Finish of Your Product

CIRCLE INFORM-A-GRAM KEY NO. 12

STANDARDIZED UNIVERSAL INDEX PLUNGERS

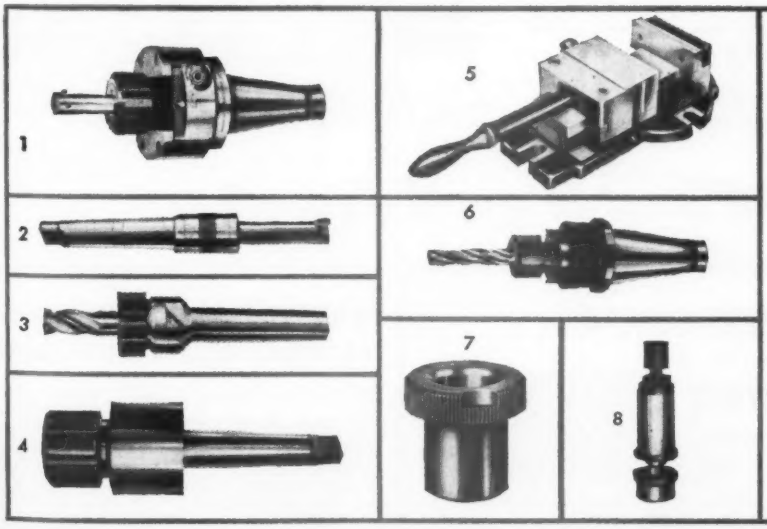
SAVE TIME SAVE MONEY

Universal's Straight and Taper Plungers made in standard sizes save the time and expense of designing and machining special index plungers for multi-station tools. They come to you complete, ready for installation at approximately ¼ the cost of specially made plungers.

Soft pin knob permits connection to actuating lever or air cylinders by several different methods. Locating bushing, plunger and plunger bushing are hardened and ground.

Plunger is easily assembled from either top or bottom. And it can be removed in either direction by removal of hex nut.

Universal Plungers greatly simplify jig or fixture manufacture because plunger body and bushing have same diameter so that all holes can be bored with same tool, often in same setting.



UNIVERSAL ENGINEERING COMPANY

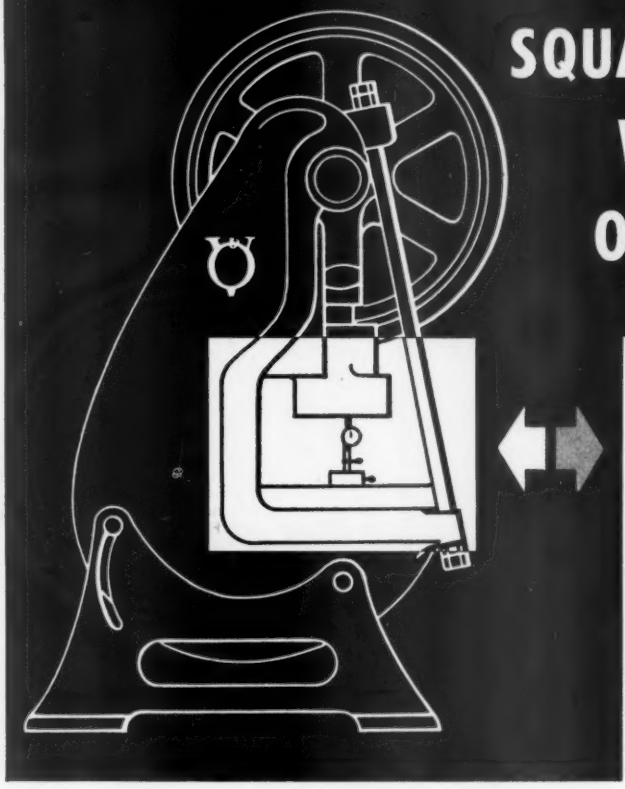
FRANKENMUTH 8 MICHIGAN

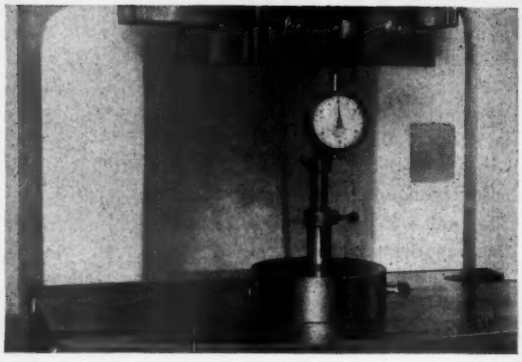
(1) BORING CHUCK
(2) MIKRO-LOK BORING BAR
(3) STANDARD COLLET CHUCK
(4) FLOATING COLLET CHUCK
(5) WEDGE-LOCK PRODUCTION VISE
(6) "KWIK-SWITCH" TOOL HOLDER
(7) STANDARD DRILL BUSHING
(8) UNIVERSAL INDEX PLUNGER

168

CIRCLE INFORM-A-GRAM KEY NO. 13

SQUARE AND PARALLEL WITHIN .0005" ON A 4" STROKE





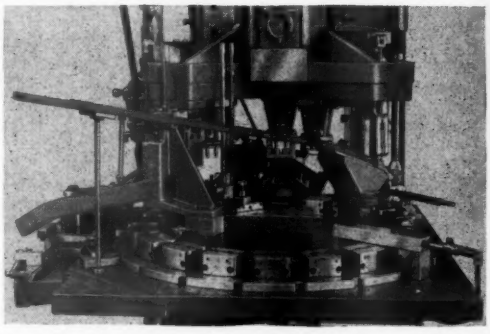
The dial indicator gage may not show a variance greater than .0005" when measuring any opposed points on these two surfaces. The same indicator is used with a ground steel square to check slide travel both F-B and R-L.

That sounds like a machine tool specification, doesn't it? Actually, it is a standard specification for a V & O long slide press: the press that is built like a high grade machine tool. We make special presses to even closer specs.

Operating precision of that order is very important if you want to use carbide dies, or fabricate thin materials, or do deep drawing, or work to high precision. You can do more, and do it better, when your press is highly accurate.

From our viewpoint, since we are going to use long slides we might as well build the rest of the press with accuracy to match. Otherwise, the precision of the long slide would be wasted. So we make extremely accurate ways and use them as reference surfaces with which all the tool carrying parts of the press must line up. And that gives you a press that will do a lot more for you.

Our representative would like to tell you more about the press that is built like a high grade machine tool. Write us, please.



Without high precision relationships between the tool-bearing surfaces and the slide travel of the press the maintenance costs of tooling of this complexity would be prohibitive.

Only the best is good enough

THE V & O PRESS COMPANY

DIVISION OF EMHART MFG. CO.

HUDSON, NEW YORK

BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

65th Anniversary

★ *STOP AND SAY HELLO AT ASTE SHOW-BOOTH 1056*

WHY THE V&O LONG SLIDE PROVIDES BETTER ALIGNMENT

With the same running clearance, the longer the slide the less the possibility for angular misalignment. And we keep our running clearances very close indeed.

CIRCLE INFORM-A-GRAM KEY NO. 14

"Desegatized"®
high production
AIR-HARDENING
Die Steel*
Manufactured under
Patent No. 2204283

Tests show as much as **50%** reduction in machining time

No change in physical properties or in the heat treatment normally associated with D-2 type die steel.

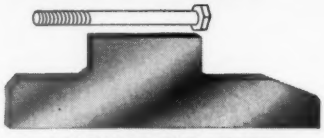
Contact your Latrobe representative or write direct to Latrobe, Pa. for complete information.

*D-2 Type

Latrobe
STEEL COMPANY
LATROBE, PA.

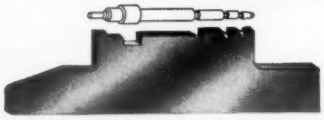
Branch Offices and Warehouses — BOSTON BUFFALO CHICAGO CLEVELAND DAYTON DETROIT HARTFORD LOS ANGELES MILWAUKEE NEWARK PHILADELPHIA PITTSBURGH ST. LOUIS ST. PAUL TOLEDO.
Sales Agents — ATLANTA CHARLOTTE DALLAS DENVER HOUSTON SALT LAKE CITY WICHITA
European Offices — GENEVA BRUSSELS PARIS MILAN ROTTERDAM DUSSELDORF

Talide Blades Any Size — Any Shape



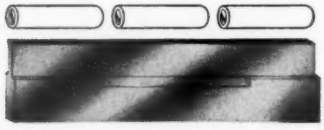
LEADING BOLT MAKER

PART.....Hardened Alloy Steel Stripper Bolt.
OPERATION.....Grind O.D. of bolt body.
MACHINE.....No. 2 Cincinnati Centerless Grinder.
BLADE.....Standard Talide-tipped Infeed work support blade No. 223877.
RESULTS.....Talide-tipped blade gave 1600 hours of continuous service compared with normal production of 20 hours obtained with high-speed steel blade.



LARGE ELECTRIC MOTOR PLANT

PART.....Stainless Steel Rotor Shaft for Electric Motor.
OPERATION.....Grind 7 diameters simultaneously.
MACHINE.....No. 2 Cincinnati Centerless Grinder.
BLADE.....Special multiple step Talide-tipped work support blade No. C-4884.
RESULTS.....Talide-tipped blade in continuous production for 91 days (2 turns per day) compared to best previous production run of 3 days with hard alloy steel blade.



LARGE MID-WEST BUSHING PRODUCER

PART.....Cast Bronze Bushing.
OPERATION.....Grind O.D. of bushing body.
MACHINE.....No. 12 Landis Centerless Grinder.
BLADE.....Standard Talide-tipped thru-feed work support Blade No. CA-32328.
RESULTS.....Talide-tipped blade maintained size without scoring or scratching while grinding 1,000,000 hard bronze bushings—previous Stellite blade wore out after grinding only 40,000.

One-piece Talide strip (up to 100" without seams) prevents scoring and scratching. Write for new 84-page Catalog 54-G or ask for sales engineer to call. Metal Carbides Corporation, Youngstown 7, Ohio.

METAL CARBIDES CORPORATION
TALIDE
YOUNGSTOWN 7, OHIO

SINTERED CARBIDES · HOT PRESSED CARBIDES
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

CIRCLE INFORM-A-GRAM KEY NO. 16

BEST GRIP in the BUSINESS-

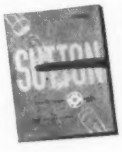
Sutton Collets and feeders!

COLLETS FOR ALL TYPES OF MACHINES

Sutton Collets satisfy thousands of users because they run true and they hold true! The famous "Diamond Grip" serrations, exclusive in Sutton collets, attack horizontal and rotating thrusts at an angle—work is gripped tighter, spoilage is reduced, life of chucking mechanism is prolonged under a reduced tension, and the collet is self-cleaned of scale, chips and dirt.

Uniform Temper and Tension

Equally important is Sutton's modern and exclusive heat treat method, which localizes controlled heat to give uniform spring temper on all collets and uniform tension on all feeders. This uniformity of temper and tension provides added useful life to the collet and feeder, thus saving greatly on down-time.



Write for Catalog 18

26 pages complete with valuable collet and feeder information and specifications. Sent Free!

Style "QC" Quick Change Master Collet
Style "F" Full Floating Master Collet
Push-out Type Standard Collet
Draw Type Standard Collet
Super Heavy Duty Feeder

All Popular Sizes Carried in Stock For Immediate Delivery!

SUTTON Diamond Grip COLLETS

FEEDERS and TOOLS

Sutton Tool Co., Dept. TP-3, Sturgis, Mich.

Suttons Run as True as the Spindle

CIRCLE INFORM-A-GRAM KEY NO. 17

KEEP FLYING CHIPS WHERE THEY BELONG

by using DILLEY Magnetic Grip-Shields

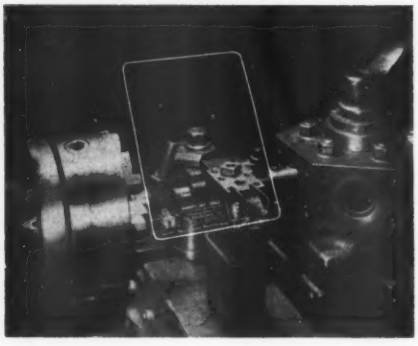
All sizes of DILLEY Plastic Shields fit the magnetic base. One lock-nut permits quick and easy change to any size shield desired.

No flying chips can reach these eyes! The Grip-Shield allows close inspection and clear vision without danger at all times.

Permanent Alnico Magnet allows attachment to any part of machine. Note how the Grip-Shield rides with cutting tool, effectively blocking flying chips and guiding them to one side where they belong.

Two-way positioning arm allows adjustment of Grip-Shield to any angle desired. Can be adjusted for any type of chip-cutting job.

DILLEY Magnetic Grip-Shields are practical, economical, safe and easy to use, and never get in the way. Tried and proved in industry by tool engineers, by safety engineers, by management and by workers.



Sizes	Each for 1 — 11	Each for 12 — 23	Each for 24 or more
6"x8"	$8.20*	$8.05*	$7.80*
8"x10"	9.25	9.10	8.85
10"x12"	10.10	9.85	9.60
12"x16"	12.10	11.90	11.65

All DILLEY Plastic Shields are ⅛" thick.

On orders of mixed sizes, lowest applicable rates apply. Other sizes on request.

ORDER A MAGNETIC GRIP-SHIELD FOR EACH OF YOUR CHIP-THROWING MACHINES.

Use this handy coupon for ordering direct from us or for requisitioning from your purchasing department.

HANDY PRODUCTS P.O. Box 2447 CLEVELAND 12, OHIO

SEND IMMEDIATELY THE QUANTITY AND SIZE DILLEY UNITS LISTED BELOW:

Quantity	Size	Price	Total
.....	6"x8" Magnetic Grip-Shields @	.....	.....
.....	8"x10" Magnetic Grip-Shields @	.....	.....
.....	10"x12" Magnetic Grip-Shields @	.....	.....
.....	12"x16" Magnetic Grip-Shields @	.....	.....

TOTAL AMOUNT OF ORDER

$_____

NAME .....

STREET .....

CITY..... ZONE..... STATE.....

ORDERED BY..... DEPT.....

☐ Open Account. Purchase Order Enclosed.

☐ Check or Money Order Enclosed.

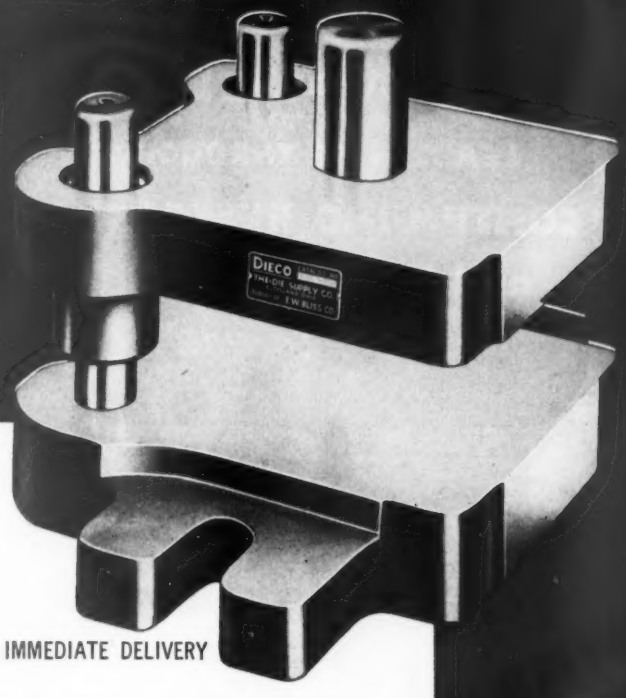
No C.O.D.'s, Please.

*Ohio customers add 3% Sales Tax.

INDUSTRY SPECIFIES

DIECO

DIE SETS



1728 combinations—
all-steel—semi-steel

Special and stock sizes

Most sizes and types available for IMMEDIATE DELIVERY

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PITTSBURGH 122 South Sheridan Avenue, EMerson 1-0440

DAYTON The Die Supply Sales Co., 311 Vermont Ave., MI 9691 TWX-DY-85

BUFFALO Die Supply Corporation, 234 Carolina Street, MAdison 1964

ST. LOUIS Scott Special Tools, Inc., 1252 North Kingshighway, FOrest 3454

New plant and office at:

DETROIT 20201 Sherwood Avenue

Write for your copy
of Catalog No. 6-A.

BLISS

Industry's most complete line of die sets and die makers supplies

DIECO

The DIE SUPPLY Company

E. W. BLISS Company

WHAT WALES LEADERSHIP THROUGH CONTINUING RESEARCH and DEVELOPMENT *means to you*

1928 WALES *Strippits* revolutionize die making by providing a spring held compressed by a retainer to standardize stripping pressures.

1932 WALES *Self-Contained Hole Punching Units* incorporate the basic Strippit principle to provide free-floating punch and guide for independent design.

1936 WALES *Self-Contained Notching Units* are an outgrowth of the successful applications of Wales Hole Punching Units and Wales Strippits.

1943 WALES *Fabricators* provide rapid interchangeability for punching, notching and nibbling . . . no templates required. Work from prints or operation sheets.

1946 WALES *Drilling Machines* are designed to meet precision requirements of locating, drilling, boring and reaming holes . . . no other drilling machine or jig borer like it.

1951 WALES *Hydra Springs* utilize the compressibility of Wales Comproils to provide up to 600% more pressure than conventional springs.

1952 WALES *Hydra-Strip Hole Punching Units* with built-in Wales Hydra Springs permit these self-contained Units to punch and strip material up to 3/4" thick.

● This chronological array of Wales patented equipment is only a partial list of the numerous exclusive products developed through years of research by Wales Engineers.

That is one of many reasons why thousands of manufacturers have made it a standard practice rule to standardize on Wales developments. You, too, will be years ahead in time-saving, money-saving production techniques by putting Wales Equipment to work in your plant.

To assist you, Wales Sales Engineers are strategically located throughout the country. These engineers are more than just "factory trained" . . . they have been employed by this Corporation for years before servicing prospects and customers.

For further information on how WALES products will modernize your operations, write for illustrated catalogs TODAY.

WALES-STRIPPIT CORPORATION

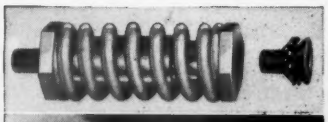
George F. Wales, *Chairman*

355 Payne Avenue, North Tonawanda, N. Y.

(Between Buffalo and Niagara Falls)

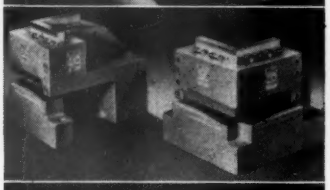
Wales-Strippit of Canada, Ltd., Hamilton, Ontario

Specialists in Punching and Notching Equipment

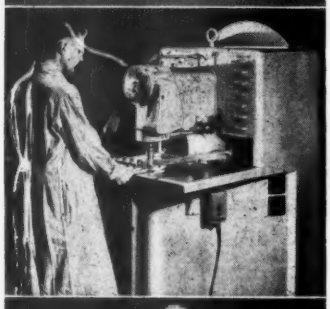


1928

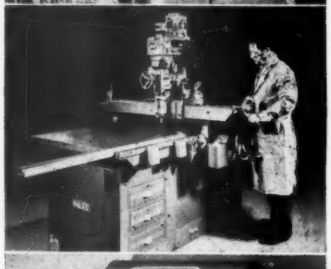
1932



1936



1943



1946

1951

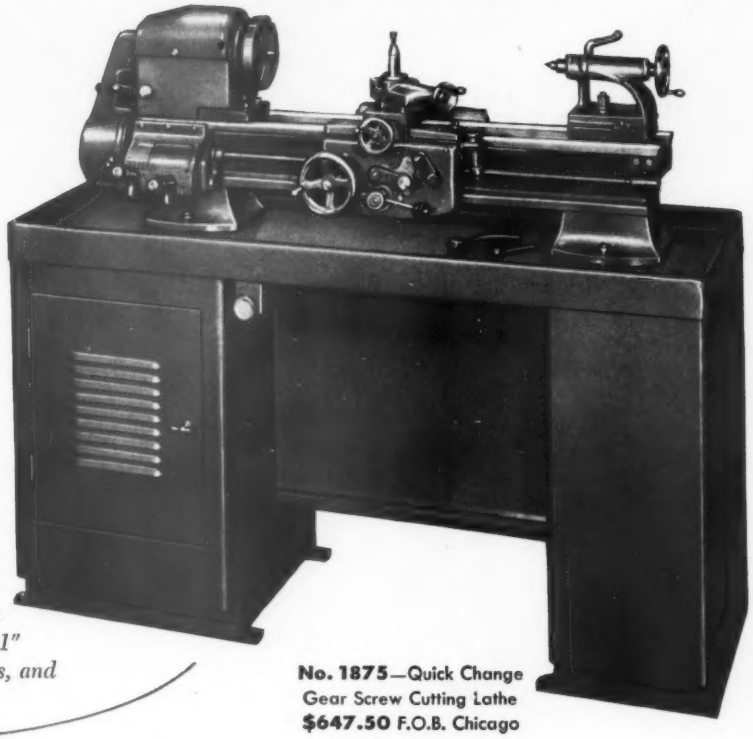
1952

?

195–

THIS Logan 10" SWING * LATHE

WILL DO THE JOB AND CUT THE COSTS...WHEREVER YOU USE IT



No. 1875—Quick Change Gear Screw Cutting Lathe
$647.50 F.O.B. Chicago

* *One of the many in the complete Logan line of 9", 10", 11" and 12" swing Lathes, and 8" Shapers.*

Brief Facts

Swing over bed, 10½"

Center Distance, 24"

Bed Width, 6 13/16"

Ball Bearing Spindle

Spindle Hole, 25/32"

16 Spindle Speeds, 38 to 1230 rpm

Double V-belt Drive for extra power to spindle is completely enclosed

Threads—46 selections, RH or LH—4 to 216 per inch

This trim, compact, 10" swing Logan Lathe is built with advanced design features and to precision standards outstanding in its field. Its spindle turns on pre-loaded *ball* bearings of extreme precision, so adaptable to all speeds they need no adjustment in the full range of 38 to 1230 rpm. The automatic apron, double-walled and friction-free, with spline driven power cross feed, has a convenient, lever-operated disc-type clutch. The two V-ways and two flat ways of the heavy-ribbed, special alloy bed are precision ground to within .0005" of perfect alignment. At vital wear points self-lubricating bronze bearings minimize friction and sustain accuracy.

Because that's the way it's built, this lathe holds exacting tolerances through extra years in production, tool room, or maintenance work. It saves space. It cuts power costs. Quick, easy set-ups minimize time loss. Apprentice operators find it easy to handle. Its price shares with you the major savings of finer tooling and efficient production in the modern Logan Plant. Ask your Logan Lathe dealer for full facts.

Write for the Logan Lathe Catalog

Logan ENGINEERING CO.
Lawrence and Lamon Avenues, Chicago 30, Illinois

LOOK TO Logan FOR BETTER LATHES AND SHAPERS

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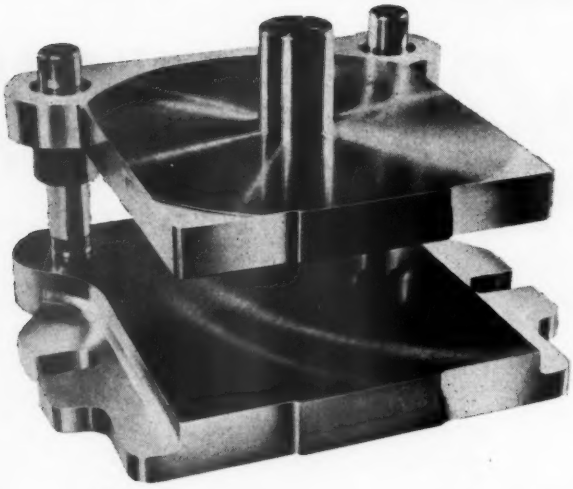

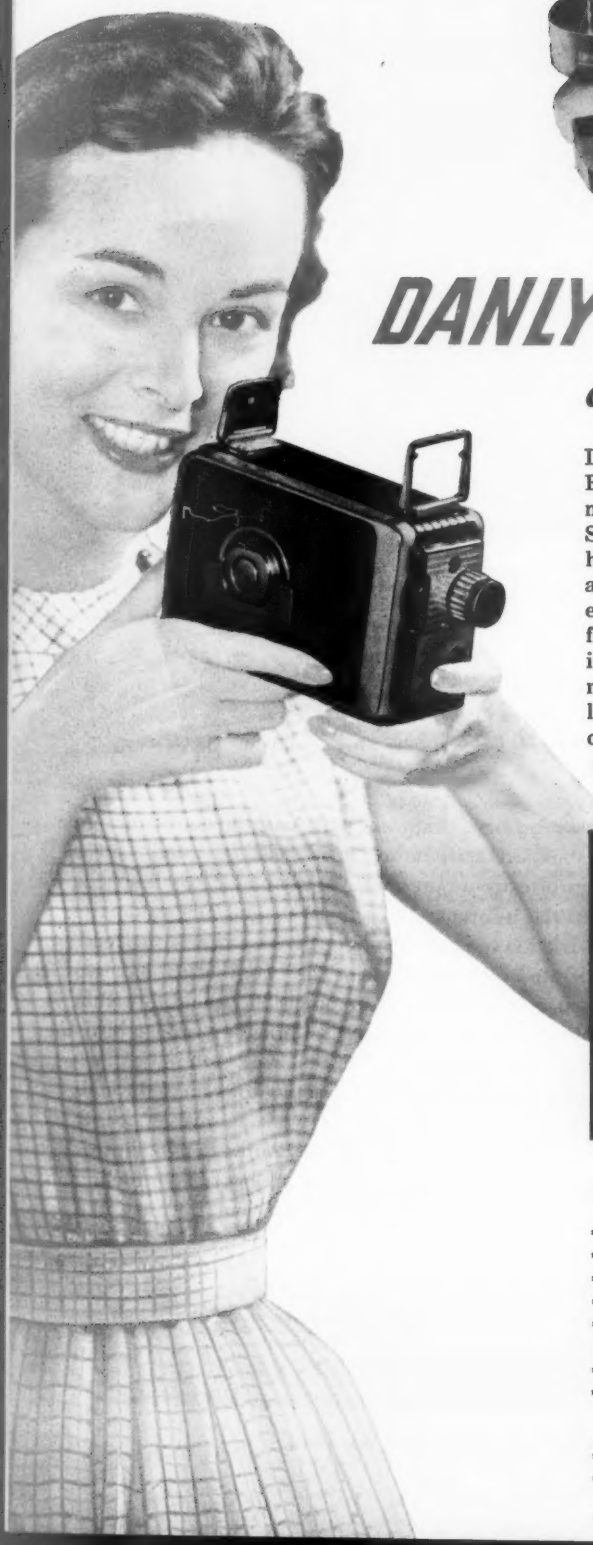

DANLY'S IN THE PICTURE

at Eastman Kodak Company

Danly Die Sets play an important role in the manufacture of Eastman's popular new Brownie movie camera and Brownie movie projectors . . . latest in the Eastman line that Danly Die Sets have helped build all through the years. Used to mount high precision dies, Danly Die Sets help bring "master die" accuracy to every finished part. But Danly Die Sets do more . . . even before a press run ever starts. They make tooling-up easier, faster—save you many, many hours in the die shop. And once in production, these same Danly Die Sets do their share to maintain non-stop production . . . save down-time . . . increase die life. And remember, Danly Die Set service is as quick and convenient as a phone call.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

DANLY

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

PICK THE DANLY BRANCH NEAREST YOU!

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***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
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**Indicates complete stock.*

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CINCINNATI Hole Hog Drill Press
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NILES Radial Drill Press
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Now A Beaver QUICK-CHANGE HOLDER With . . .

New adaptable Morse Taper Shank and Adaptor Plug

With this new shank and adaptor plug Beaver has developed a holder that is adaptable with the proper plug to 98% of American and foreign made machine tools equipped with No. 5 or No. 6 Morse Taper Sockets.

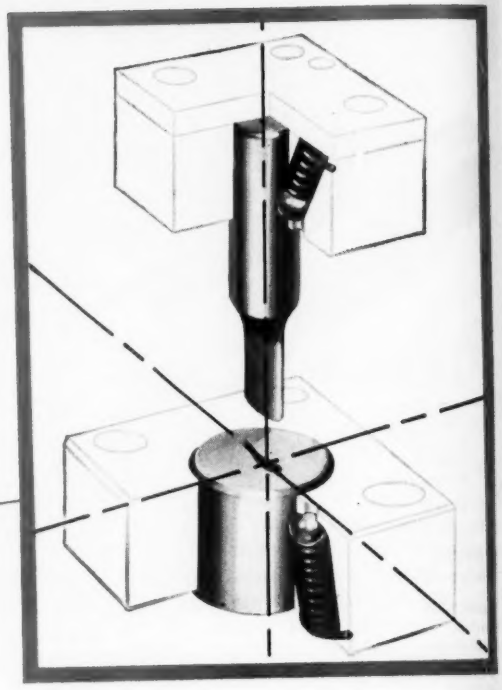
WE'LL SEE YOU AT BOOTH 517 A. S. T. E. SHOW

Beaver TOOL AND ENGINEERING CORPORATION

BOX 429, ROYAL OAK, MICH., Teletype - Big Beaver 648

CIRCLE INFORM-A-GRAM KEY NO. 23

WHY R-B Punches are easier to use



Just a push, a twist, and "click" your R-B punch or die button is accurately ALIGNED and LOCKED in place. The R-B ball lock prevents radial or vertical movement of the punch or die button in the retainer—no additional keying is required.

R-B punches and die buttons are just as easy to remove—simply insert tanged tool in retainer hole to release ball lock. Standardized and completely interchangeable in any shape or size, these easy to use punches and die buttons save your time and energy.

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 74 • 12635 BURT RD. • DETROIT 23, MICHIGAN

Please send me additional information.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

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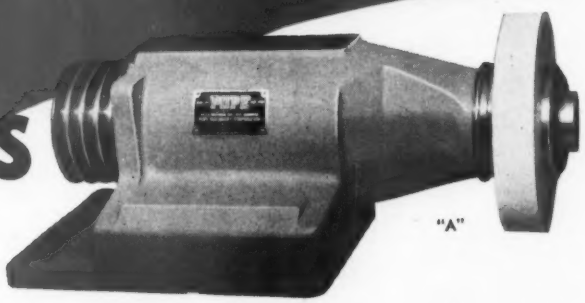
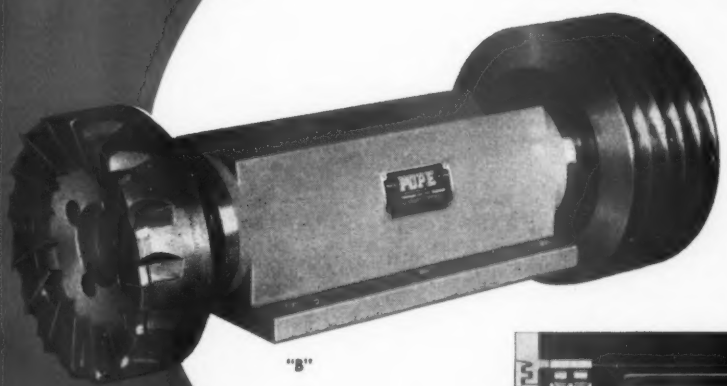
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

CIRCLE INFORM-A-GRAM KEY NO. 24

Specify POPE

HEAVY DUTY WHEEL HEADS

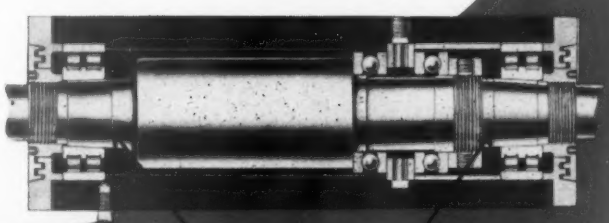




Note the big precision bearings and the big shaft.

A pair of precision thrust bearings stabilize the shaft against any axial movement in either direction. (No end play)

The double row cylindrical roller bearings carry the radial loads with ease and at low temperature.



Send us your specifications and ask for quotations.

Taper mounting provides for precise individual preloading of the radial bearings.

POPE Heavy Duty Wheel-Head Spindles are designed for a wide variety of applications such as grinding, boring, milling, drilling and many other operations requiring PRECISION COMBINED WITH RUGGEDNESS in the spindles.

For continuous production and trouble-free operation THERE'S NOTHING LIKE A POPE SPINDLE WITH ROLLER BEARINGS.

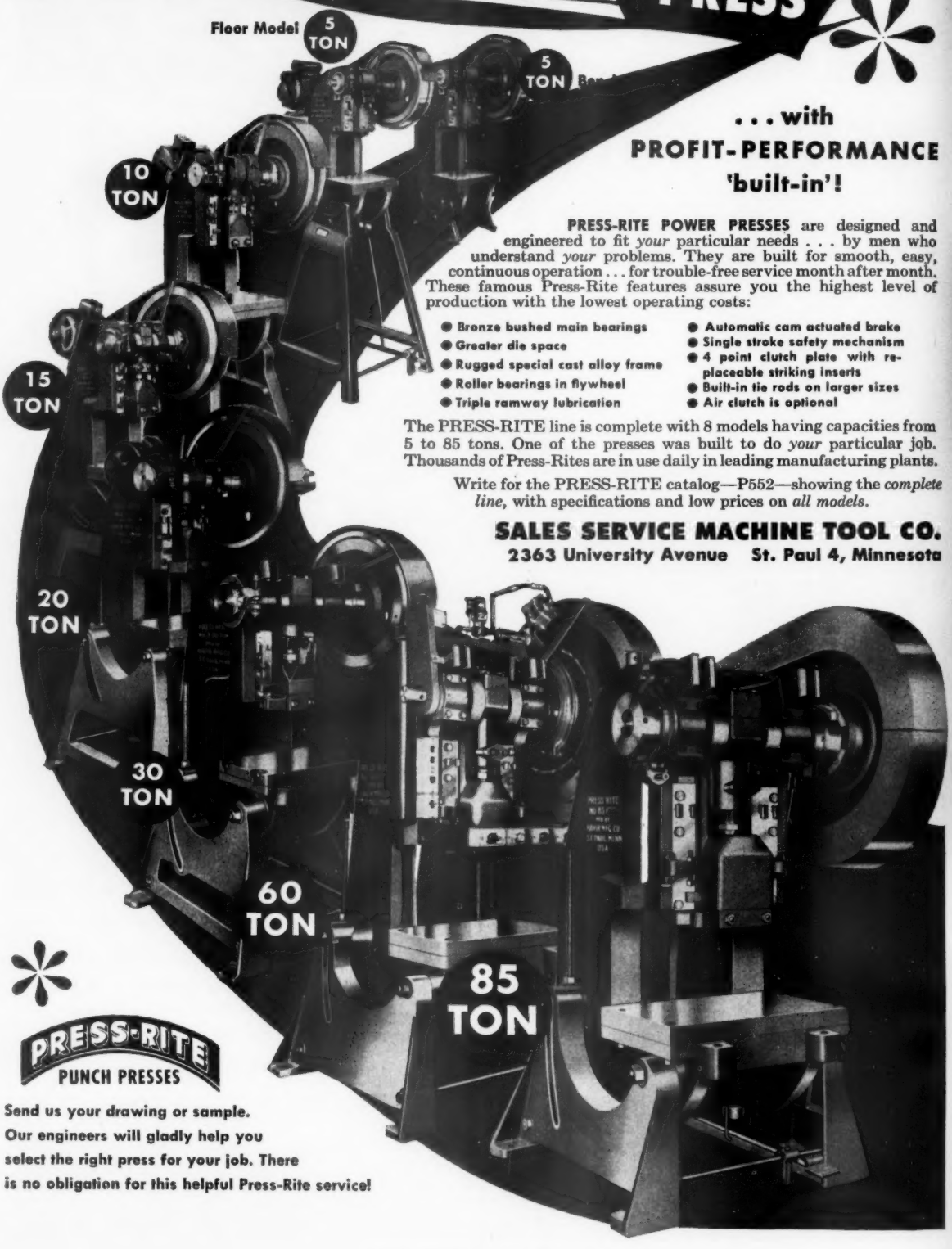
No. 94

Specify POPE® PRECISION SPINDLES

POPE MACHINERY CORPORATION
Established 1920
261 RIVER STREET • HAVERHILL, MASSACHUSETTS

CIRCLE INFORM-A-GRAM KEY NO. 25

SELECT THE RIGHT PRESS



. . . with PROFIT-PERFORMANCE 'built-in'!

PRESS-RITE POWER PRESSES are designed and engineered to fit *your* particular needs . . . by men who understand *your* problems. They are built for smooth, easy, continuous operation . . . for trouble-free service month after month. These famous Press-Rite features assure you the highest level of production with the lowest operating costs:

- Bronze bushed main bearings
- Greater die space
- Rugged special cast alloy frame
- Roller bearings in flywheel
- Triple ramway lubrication
- Automatic cam actuated brake
- Single stroke safety mechanism
- 4 point clutch plate with replaceable striking inserts
- Built-in tie rods on larger sizes
- Air clutch is optional

The PRESS-RITE line is complete with 8 models having capacities from 5 to 85 tons. One of the presses was built to do *your* particular job. Thousands of Press-Rites are in use daily in leading manufacturing plants.

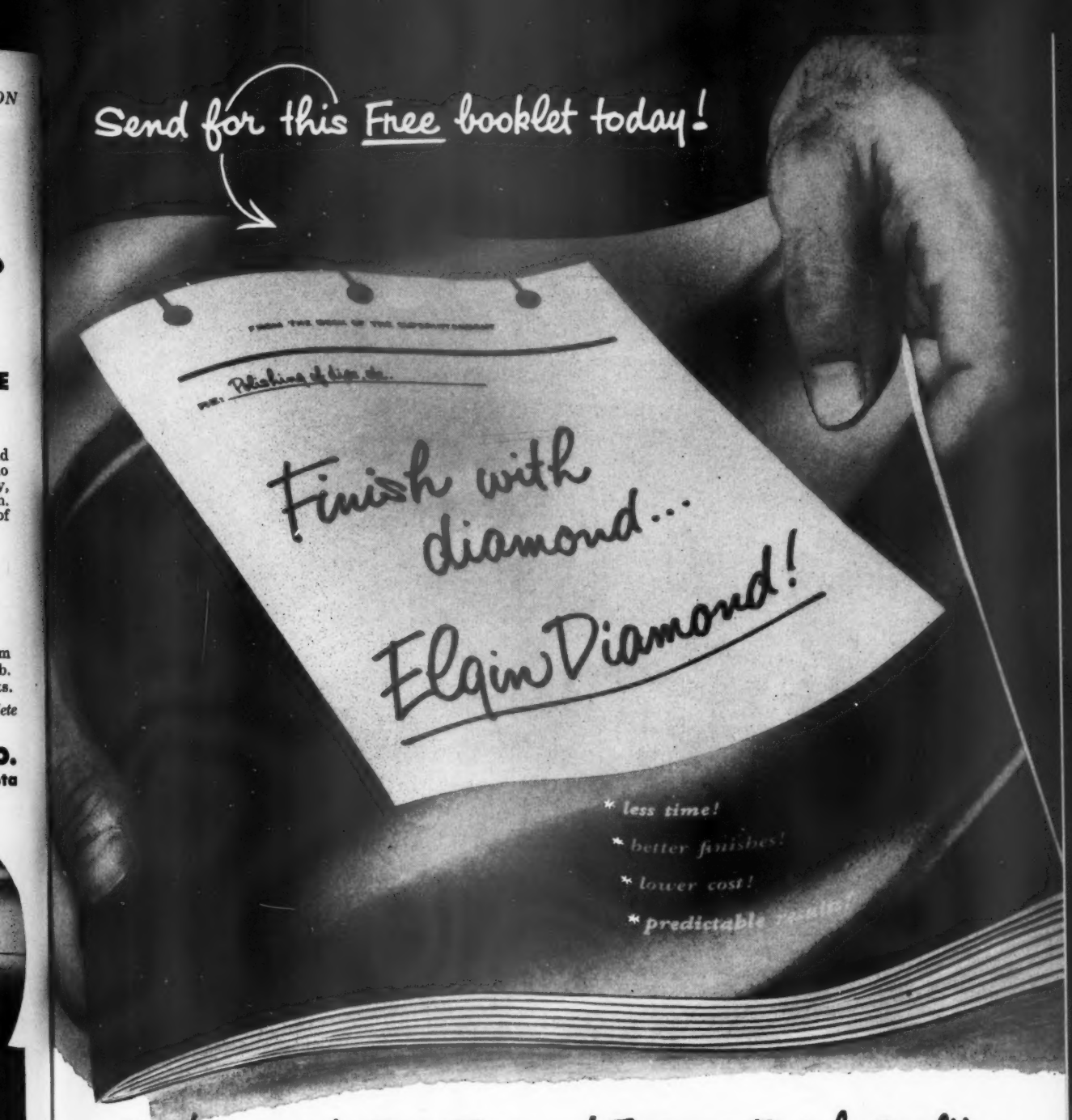
Write for the PRESS-RITE catalog—P552—showing the *complete line*, with specifications and low prices on *all models*.

SALES SERVICE MACHINE TOOL CO.
2363 University Avenue St. Paul 4, Minnesota

PRESS-RITE PUNCH PRESSES

Send us your drawing or sample. Our engineers will gladly help you select the right press for your job. There is no obligation for this helpful Press-Rite service!

CIRCLE INFORM-A-GRAM KEY NO. 26



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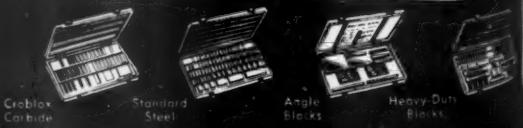
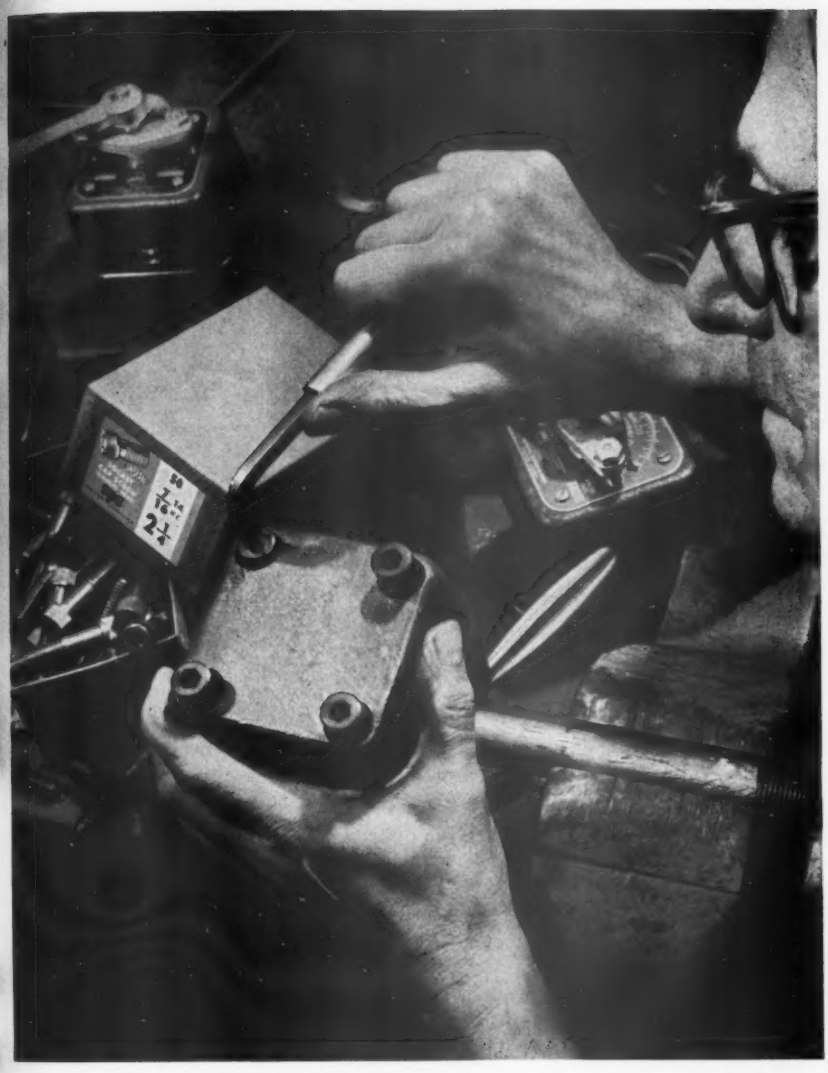
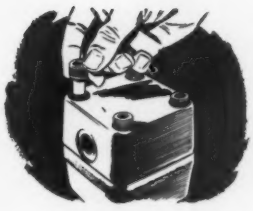
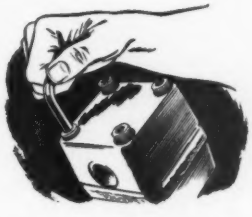




Four UNBRAKO Socket Head Cap Screws speed assembly in the plant, and reassembly in the field, of these flow-control valves providing 16 different inlet-outlet flow direction combinations.



The knurling on the head of the screw permits faster assembly, because it provides a slip-proof grip.



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When you use UNBRAKO socket screw products, you get the finest socket screws made, *plus* the personalized service and the faster delivery of your local distributor. And he enables you to cut your inventory, set up more space for production. For more information, write for UNBRAKO Standards—a complete listing of precision socket screw products carried by your distributor. STANDARD PRESSED STEEL Co., Jenkintown 36, Pa.

UNBRAKO® SOCKET SCREW DIVISION

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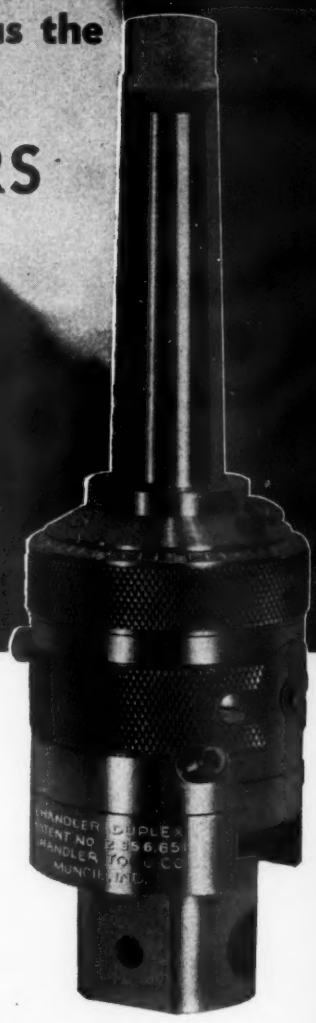

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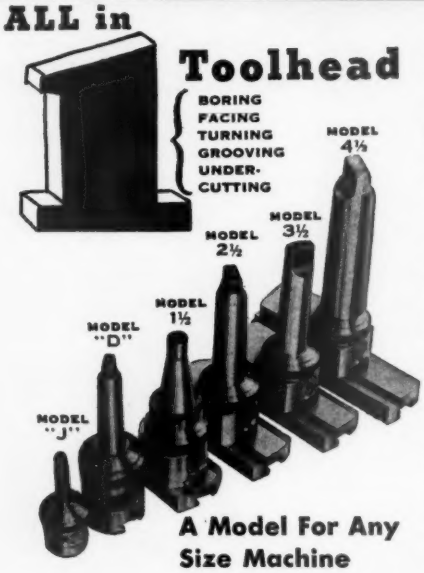

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This boring and facing head has many points not found in conventional makes . . . such as power feed for facing, longer slide travel, extremely fine adjustment, tee slot positioning of cutting bar, universal range and adaptability. All shanks are interchangeable. Any type shank, straight or tapered, with tang or threaded for draw bar furnished. Feed screw dial calibrated to read .0005. Movement of slide .025 inch per revolution of screw. Standard equipment includes bar holder, boring bar ¾x4, extension bar for large work, slide stop, feed ring handle, and necessary wrenches. Shipped in special wooden container.

A Boring Head That Won't Face is NOT Complete

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COMBINED BORING AND FACING TOOLHEADS

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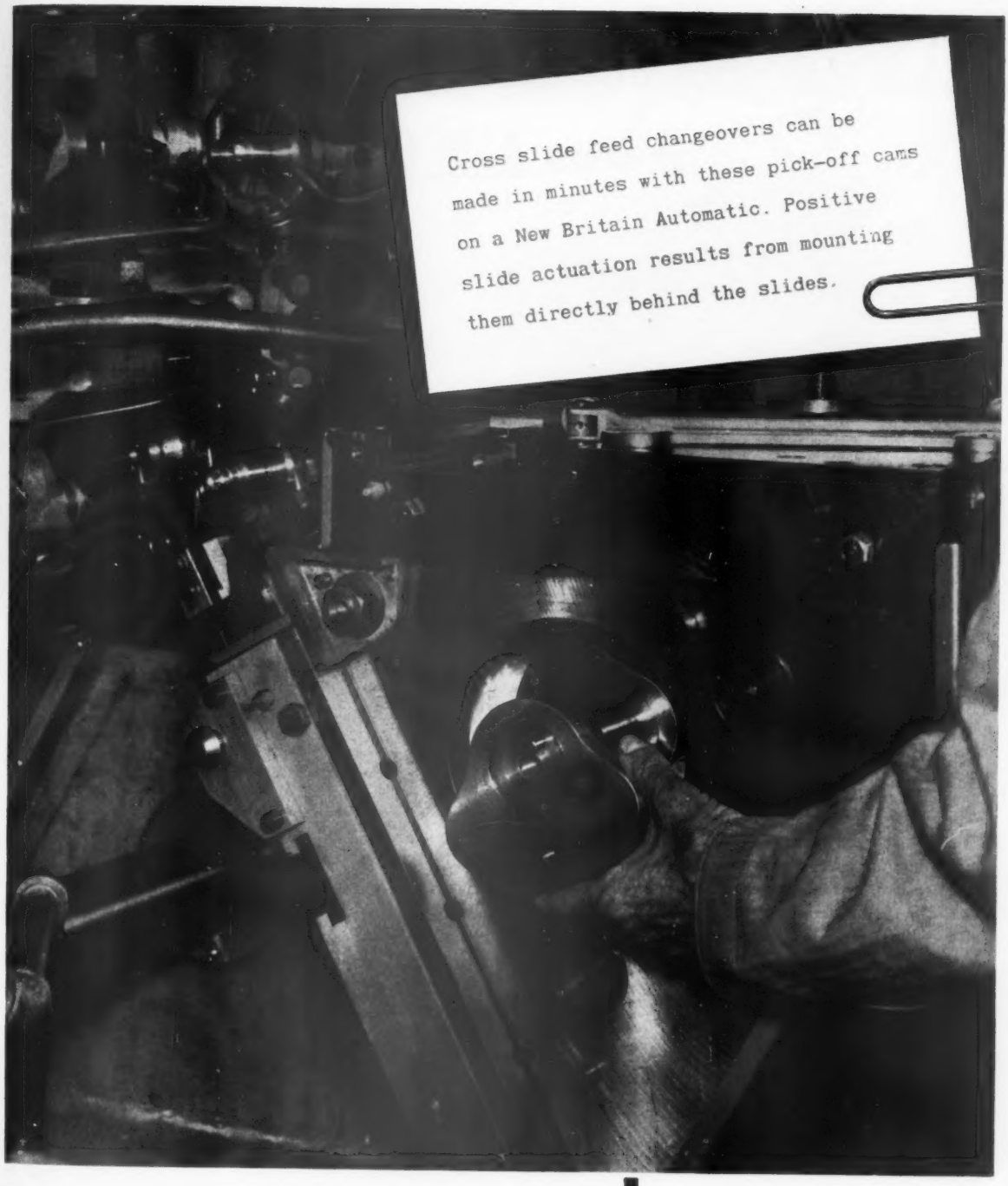
Cross slide feed changeovers can be made in minutes with these pick-off cams on a New Britain Automatic. Positive slide actuation results from mounting them directly behind the slides.

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New Britain-Gridley Machine Division, New Britain, Connecticut

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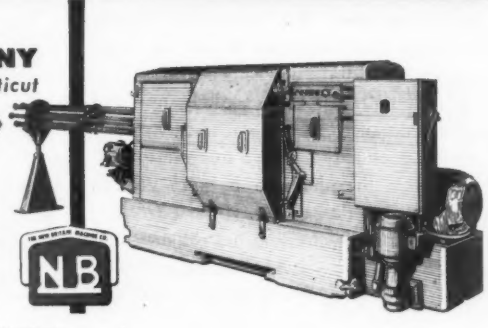

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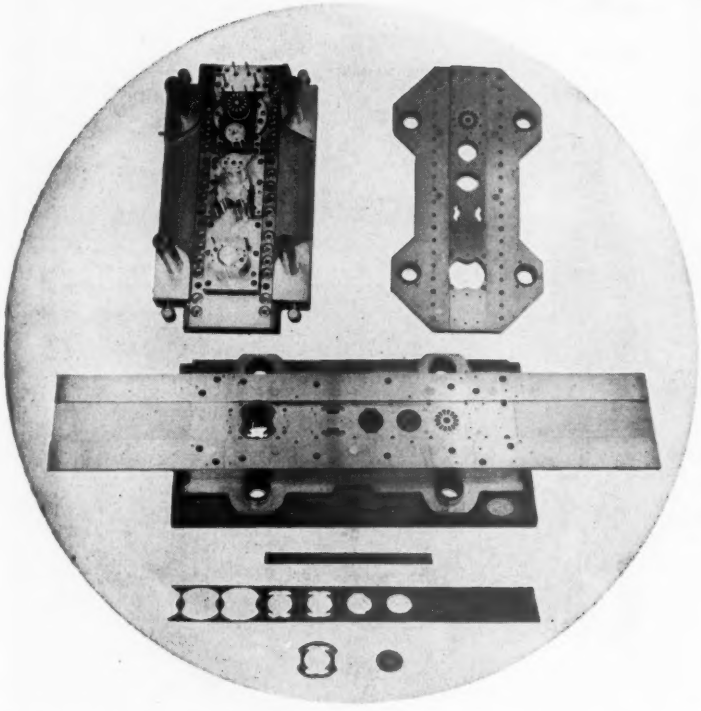
This die was not just "made"...

it was ENGINEERED



Just a choice of words, you say? No, it's more than that. The progressive steel lamination die shown here was hole-bored, hole-ground and contour-ground to pre-engineered dimensions entirely on Moore-built machines in the Moore toolroom. It exemplifies the application of *engineering* principles that put die-making on an interchangeable parts-and-assembly basis for the first time.

Let's take a close look at this die: All die sections are mounted in a hardened nickel-chrome frame for maximum production and die life; the die set was specially made by Moore. The spring stripper is guided on four main posts. High-speed inserts are set into hardened steel frames.

Moore produced all parts of the die *to figures instead of to "fit."* This was done concurrently by several toolmakers instead of progressively as a slow, one-man job.

Precision Hole Location and Contour Grinding Methods Assure Accuracy, Speed, Economy

THE NO. 2 MOORE JIG BORER bored all holes before hardening, thus holding the location as close as possible to eliminate excessive grinding. With its built-in system of accurate lead screws, the Moore Jig Borer can spot, drill, bore or ream all holes in a workpiece with minimum tool changes and to close tolerances.

No. 2 MOORE JIG BORER

Punches and dies of the first station—at the right in the photograph—were ground with a *Moore Panto-Crush Wheel Dresser*. This machine, which combines roll-crushing and diamond dressing, did the required linear contour grinding quickly and efficiently. *Moore Motorized Centers* handled several of the smaller grinding jobs.

WITH THE NO. 2 MOORE JIG GRINDER, all die sections were screwed and doweled into place, put on the machine and ground in *one* set-up. This eliminated separate section hole-grinding and the accompanying difficulty of accurately locating each section in the die bed. The Jig Grinder does the job in one-third the time required by previous methods.

No. 2 MOORE JIG GRINDER

To grind Stations 2, 3, 4, 5 and 6, the new contour-grinding and slot-grinding features of the Jig Grinder were utilized.

Die try-out and assembly operations were performed the modern, fast, "mechanized" way on the *Moore Die Flipper*.

End results? Moore equipment brings true interchangeability to the toolroom, lowers tool costs, increases toolroom capacity, prolongs die life and achieves greater accuracy.

Detailed bulletins on these machines are yours for the asking—today. Write to: Moore Special Tool Company, Inc., 726 Union Avenue, Bridgeport 7, Conn.

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J&L THREAD TOOL DIV.

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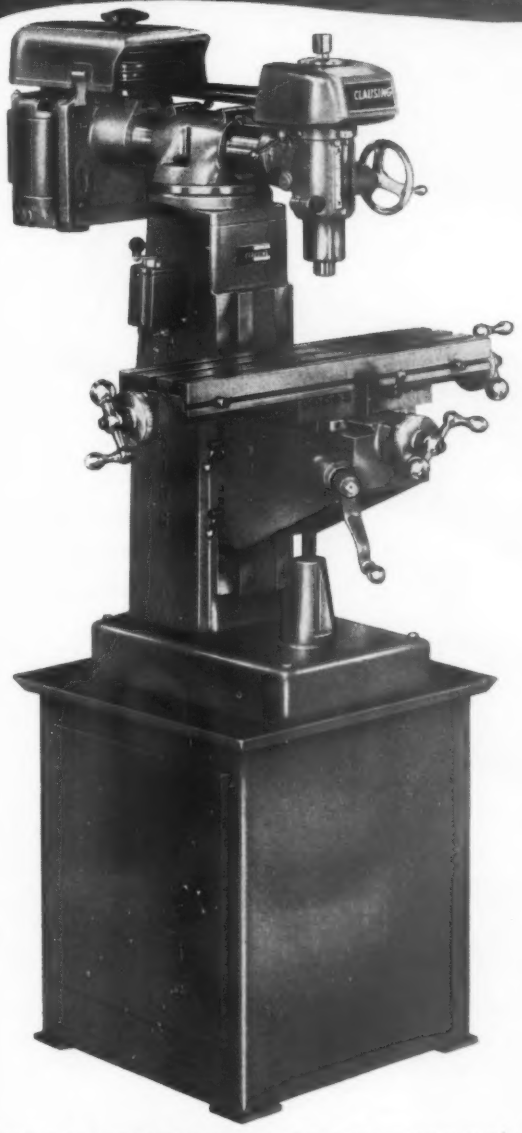

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For versatility, accuracy and economy, the new Clausing Vertical Milling Machine has more Plus Value features than have ever before been available in a miller at or near its price!

It has Versatility Plus! Especially designed for tool room, pattern shop and general purpose use, it is actually several machines combined in one. The spindle head can be swiveled in a vertical plane and set at any angle, and turret rotated in a horizontal plane making it possible to mill, drill, bore, ream and shape at all angles, with one setup.

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Quill has micrometer depth control stop and two feeds; rack controlled by lever for sensitive feed and gear controlled by hand wheel for fine feed. All feed screws have ground threads, turn on ball bearings, have large micrometer dials.

Table surfaces and dovetail ways on table, saddle, knee and column are precision ground.

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Transverse Table Travel	5"
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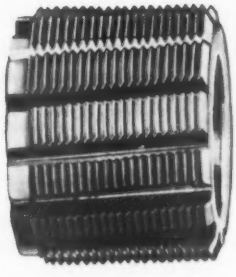

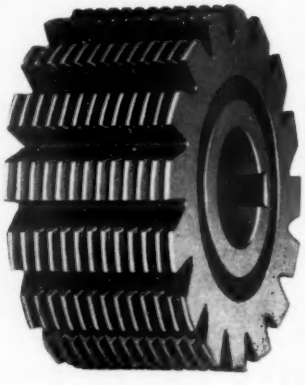

Shell Type Multiple Thread Milling Cutters

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costs - your auto parts battlefront

The economic battle that is shaping up in the automobile industry is something to behold. It is a battle made up of many skirmishes on three fronts: engineering, production, and sales. And in economic battles, as in military battles, somebody is bound to get hurt.

In our field of tooling and production, we are particularly cognizant of the problems faced by the many manufacturers who are suppliers of parts and sub-assemblies to the auto makers. These tributary industries constitute some 400 concerns, large and small, with around 400,000 employees.

Their current worries stem from the increasing tendency of the automobile manufacturers to make many parts rather than procure them from outside suppliers.

The auto makers claim, in these instances, that they can produce the parts cheaper than they can buy them. This, in spite of the astronomical overhead dollars that are in the automobile manufacturers' operations, i.e., proving grounds, motoramas, research laboratories, travelling engineering shows, weekly television "theaters", multi-page, 4-color, consumer advertising at thousands of dollars per page; "items" that to contemplate would curl the toes of the small contract manufacturer.

Each and every threaded fitting, hub cap, or door hinge that is produced by the car manufacturer has to be charged with its share of the overhead; admittedly minute, maybe incalculable, but it's there whether or not the car makers will admit it to the parts supplier as the pressure is put on for lower procurement prices.

Whatever the reasons for these moves by the car makers — production costs, maintaining of their own employment levels, union pressure, a hope of consumer market stimulation by lowered selling prices — are aside from the point.

The challenge is made, and it is up to the suppliers to meet it. It can be met and it will be met — by some.

It will be met by the enterprising and ingenious supplier who "invests for survival" in new machines, tools and methods. Comparatively, he can make changes overnight which would take the car builder months to inaugurate.

His acquisition of new machines which will enable him to both increase worker productivity and reduce costs is being made easier, capital-wise, by plans of equipment lease and rental which are coming into prominence.

The manufacturer who wants to retain his position as a supplier to the automotive industry is going to have to fight fire with fire. He must realize that the car builders have no monopoly on automation.

One year ago, March 1953, this editor's page was entitled, "Automation to Grow Down". We pointed out then the inevitable spread of the technique of automation to the manufacture of less bulky and weighty workpieces than automobile components. In pointing out that the benefits of automation are not limited to working with 200 lb. engine blocks, we ventured the following:

"Automation will come to television manufacture by way of printed circuits, stacked one on another sandwich-like, integrally molded sub-assemblies, with the whole assembly such a compact and rugged unit that it itself can be used as the forming punch around which a thin sheet protecting shell can be formed in one press stroke. If anyone doubts such a Rube Goldberg concept, just wait ten years."

Ten years? Eight months later (TOOLING and PRODUCTION, November 1953, page 72) we disclosed "Project Tinkertoy" — an automatic production line for the manufacture of electronic products Now, graced by the terms "modular design of electronics" and "mechanized production of electronics", jig, die and fixture drawings as well as an engineering handbook on the techniques are available to industry.

The only limit to the tooling and production ammunition that can be used in the battle of cost reduction is that limit imposed by lack of imagination, ingenuity, and resourcefulness. We cannot believe that the manufacturers of automobile hardware, gears and carburetors are lacking in those elements of enterprise.

On this same subject a Detroit automotive writer recently said: "Of course, auto companies do and will always depend on suppliers for many parts. Some items the auto companies can't make cheaper than their suppliers — particularly the more efficient ones."

There it is right on the line: Efficiency. That is what will separate the men from the boys in this battle for the automotive parts business.

E. Willard Pennington

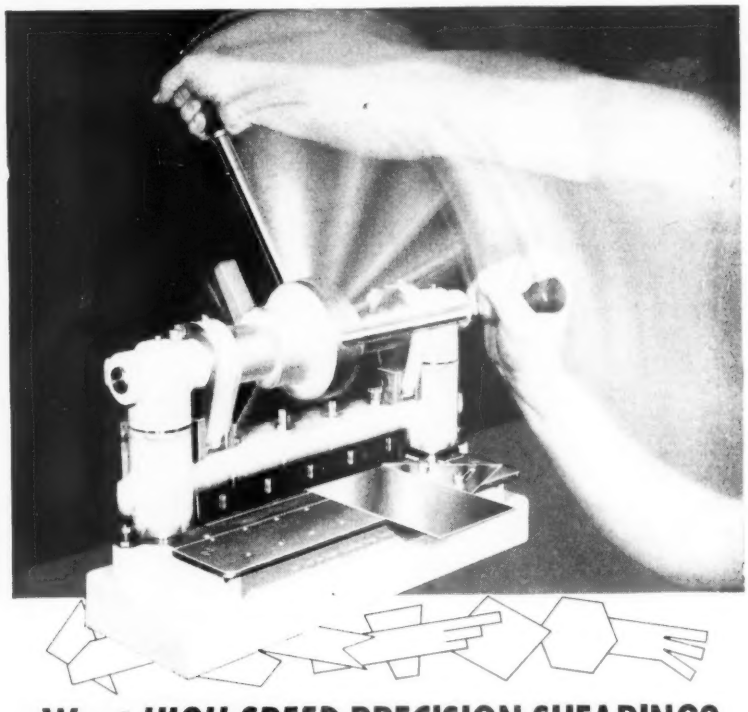
Editor

Editorial Index

DEPARTMENTS

SHOP AIDS 70
Need help in any aspect of modern metalworking? See this section for materials and design aids, inspection and production techniques.

PUBLICATION PREVIEWS 94
Capsule description of current literature. Bulletins, brochures, catalogs and circulars - - - You name it.



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— FEATURES —

Editorial—costs—your auto parts battlefront 37

TRANSFER PRESS. "Transfer Press Production of a Lamp Body" 54

An operational description of a Schuler transfer machine (English) in producing automobile side-lamp bodies using a fourteen station die.

HARDNESS TESTING. "Hardness Testing Equipment and Methods" by John E. Hyler 84

In this concluding installment magnetic hardness testers, michra-hardness testing and multiple angle hardness testers are discussed.

INDUSTRIAL T-V. "What is T-V Doing In Industry" 44

It is finding many jobs which it can do with more safety, at lesser cost, and with greater accuracy and dependability than when those jobs are entrusted to human hands.

COATED STEELS. "How About Fabricating the Zinc Coated Steels?" by Lester F. Spencer, Metallurgical Consultant 41

Zinc coated steels, known as "galvanized" do not lend themselves to mechanical working. A new process of zinc coating has been developed which eliminates the disadvantages of galvanized steel.

DIES. "Unconventional Automatic Dies" by Ernest J. Urbas, The Guarantee Specialty Mfg. Co. 46

In a unique departure from the conventional single progressive die, the "triple-multiple" die has been developed which produces three identical finished shells at each stroke of the press.

CARBIDE TOOLS. "Success of a Carbide Tool Depends Upon Shank Selection" by M. L. Backstrom, Firth Sterling Inc. 50

The broader use of carbide cutting tools has made it imperative that a closer analysis of job load conditions be made so that tool shanks of sufficient strength can be selected.

Editorial Index

TITANIUM. "Titanium . . . the Metal of 1954" by Elmer H. Hahn, Registered Professional Engineer 58

Mr. Hahn continues his discussion on Titanium problems. He treats welding, grinding, machining, casting, forging, and scrap recovery.

TITANIUM GRINDING. "Abrasive Action in Titanium Grinding" by Fred A. Upper, The Carborundum Co. . 58

Recommendations, (based on laboratory experimentation and actual field practice) for wheel speeds, wheel grit and grade, and coolants are given for different grinding operations.

TITANIUM WELDING. "Welding of Titanium" by Francis H. Stevenson, Aerojet Engineering Co. 58

Results obtained in welding titanium by different welding methods are discussed.

— SHORTS —

Hydroform Demonstrated at PMI Meeting 64
New Features Added to Big Joe Lift Trucks 69
Improve Inspection Methods with Existing Equipment 73
Gears for Small Mechanisms . . . 86
Will You Be There? 87
Broaching Two Non-Parallel Bolts 90
Titanium Bibliography 113
Industrial News 114
Longer Wheel Life Obtained with New Grinding Fluid 116
Carbide Insert 119
Prescriptions for Production 120
Setup Slugs Reduce Setup Time . 124
Plastics 128
Rotary Cross-Feed Table Speeds Die Milling 155
Darwin & Milnar Names New Sales Manager 159
Tool & Die Institute Elects New Officers 159
Millit Introduces Shell and Face Mills 163
Sperry Offers Film on Ultrasonic Test 163
Carbide on Plastics Better than HSS Tools 164

DEPARTMENTS

QUICK PIC CATALOGS 127
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PROGRESS ON PARADE 135
Check this carefully. It can bring new efficiency to your operation. The newest in machines, tools, and accessories.

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A few examples of perforator shapes that can be made faster and easier with Grind-All.

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Patent No. 2449459

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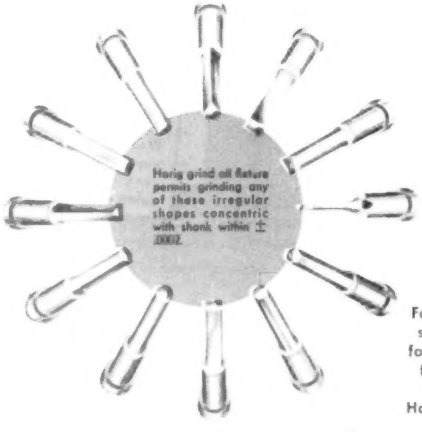

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by Lester F. Spencer
Metallurgical Consultant
Kensington, Conn.

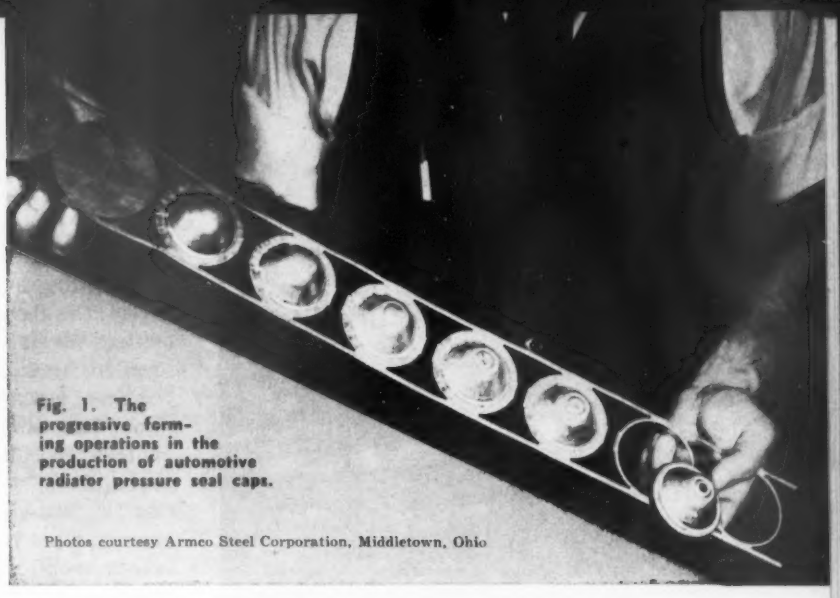

Fig. 1. The progressive forming operations in the production of automotive radiator pressure seal caps.

Photos courtesy Armco Steel Corporation, Middletown, Ohio

How About Fabricating Zinc Coated Steels?

THE SURFACE PROTECTION of steel products by the use of a zinc coating, which is produced by a method commonly known as "galvanizing" is an old and established practice; the value of this engineering material being proven by its wide usage on many applications where resistance to atmospheric corrosion is required. Extensive tests of this material have indicated that maximum performance can be realized in rural atmospheres where the air is free from sulfur gases and other industrial fumes, however, it has also been used with satisfactory results in both salt air and highly acidic industrial atmospheres. In addition, with proper procedure of application, or in the selection of material, the value of this coating in resisting a wide variety of corrosive conditions is increased by the use of a protective paint.

The effectiveness of this protective zinc coating is dependent upon specific characteristics of the coating (1), the more important of which would be: (a) under the influence of a corrosive environment, the break-down of the zinc coating will be at a relatively slow rate as compared to the unprotected base metal; (b) upon decomposition, the resultant white non-staining corrosion product is less objectionable than the iron rust that would form on an unprotected surface; and, (c) zinc, since it is electro-positive to the base metal, will offer electrolytic protection such as would be exemplified by a sheared edge. In the latter characteristic, the corrosion would be on the protective coating rather than on the exposed base metal; the extent of protection varying with the nature of the electrolyte.

The initial method in the production of this protective coating, which is still in wide usage, is known as the "hot dip" process; the characteristics of the resultant coating being dependent upon the conditions present during processing. This method of galvanizing is satisfactory on products which require little mechanical working for completion for consumer use. However, in the event that a coated sheet is required to be formed, as in press working, difficulty in coating failure will be realized. This difficulty is produced by a brittle iron-zinc alloy layer which forms between the base metal and the outer layer of pure zinc. As intimated above, both the thickness and character of this objectionable brittle zone is influenced by many factors, which would include, (a) the type of material coated; (b) the surface condition and temperature of the material upon entry into the galvanizing bath; (c) the composition and temperature of the galvanizing bath; and, (d) the time of immersion in the galvanizing bath.

The adverse influence of this iron-zinc alloy layer on the forming properties of the coated sheet is well known; this fact resulting in continual work in the minimization or elimination

Fig. 2. A slow double-action type press is recommended in the drawing of coated material.

of this brittle layer. One process, which has been developed recently and known as the "Sendzimer Process", has completely eliminated this brittle layer by controlling those variables that have been listed above. This has resulted in the production of a coated material which will withstand the maximum deformation limitations of the base metal. In addition, the very nature of the process has made it possible to obtain a controlled coating weight on strip which utilizes the economic advantages obtained in a continuous process.

This process, which is a radical departure from the conventional sheet galvanizing procedure, consists of the following:

(a) Surface preparation of the strip which consists of an oxidation of the surface and subsequent reduction of this oxidized surface. Thus, the strip enters a pre-heat furnace where the pre-heat temperature of 750 to 850 degrees Fahr. is sufficient to oxidize the surface uniformly. The annealing furnace, which is next in line, reduces this oxide; the furnace atmosphere employed being dissociated anhydrous ammonia. This reducing atmosphere is also employed in the cooling section of the annealing furnace so as to maintain the desired surface condition up to the time of entry into the galvanizing bath.

(b) The temperature of the base metal, as it enters the galvanizing bath, is accurately controlled; the temperature of strip being at a value of 900 to 950 degrees Fahr.

(c) The composition of the bath remains within specified limits; aluminum additions being made so as to completely eliminate this brittle iron-zinc alloy layer. Since the galvanizing pot is also under the influence of the above mentioned reducing atmosphere, a flux is not required; this precluding a more accurate control and maintainance of the aluminum inhibitor at the desired percentage. In addition, the zinc bath temperature is maintained between 850 and 860 degrees Fahr.

(d) The surface quality of the coated sheet is maintained by the use of a mechanical scraping device attached to the exit rolls to prevent the deposition of oxide or dross. These exit rolls also serve as a means of regulating weight and uniformity of coating.

Actual work with this material, which has been produced under the trade term of Zincgrip*, along with numerous case histories available indicates that neither peeling or flaking of coating will result during a drawing operation. The coating actually stretches to conform with the curvature of the formed piece. This condition can be readily determined by submitting a sample of the coated stock to a laboratory test such as the Olsen Cup Tester. Due to the oxidizing-reducing conditions of the process, the base material composition is limited to either ingot iron, a mild open hearth steel or copper bearing steel which has a minimum of 0.02% percent copper within the base analysis. However, in press draw work, these compositions are in predominance.

As mentioned previously, further protection of the zinc coating can be obtained by the use of a paint. Although the untreated zinc coat-

*Trade term Armco Steel Corp.

Fig. 3. The sequence of draws for this liquid container.

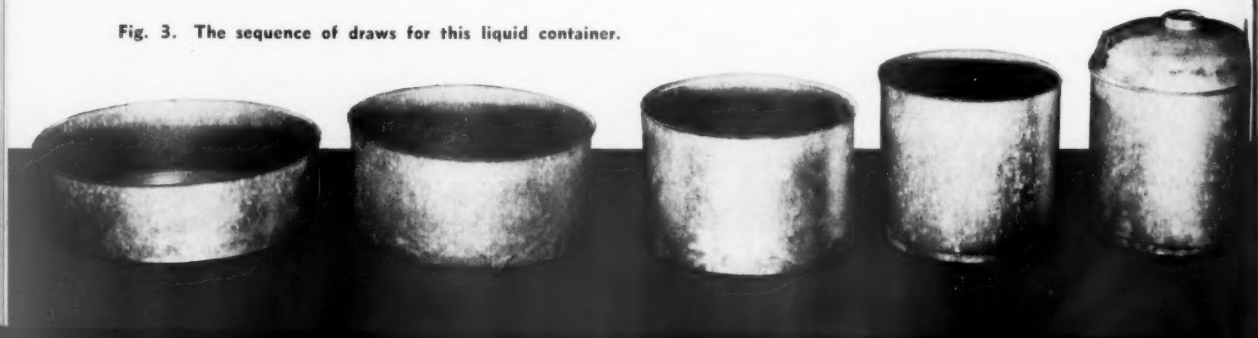

Fig. 4. A typical completed part produced from zinc coated stock.

ing can be painted, the procedures used may be troublesome and costly and, in addition, early failure of finish may occur. Thus, it is recommended that a phosphate coating be applied to the coated surface prior to decorative painting to obtain the required adherance. In accordance to those factors of design of part, facilities available in the individual plant and the operational procedure, this phosphate coating can be placed on the zinc coated sheet at the mill, or, as a preliminary operation on the formed piece at the individual plant prior to metal finishing.

One prerequisite in the storage of zinc coated materials is that the warehouse be dry and of uniform temperature. Thus, sudden drops in temperature will cause condensation; this moisture will discolor the sheet producing a white rusting effect which, if given sufficient time, may eventually damage the coating. Where it may be necessary to store zinc coated sheets in an open or damp room, it is suggested ([3]) that the sheets be placed on edge and separated slightly to allow for air circulation. Thus, this white rusting will occur when in contact with moisture provided there is no access to air. This white rusting, which usually does not appreciably affect the durability of the sheet, but may be objectionable from the appearance standpoint, is usually a formation of a zinc carbonate and zinc oxide or a zinc hydroxide.

In the event that the staining or white rusting is superficial, removal may be realized by mere scrubbing with hot water. In extreme cases, it may be necessary to employ a three percent chromic acid wash. As an alternate method, a one percent solution of tri-sodium phosphate may be employed. In any cleaning operation, hot water rinses are employed to remove excess which is followed by drying with compressed air. The sheets should then be placed on edge and separated slightly to provide for the circulation of air. It should be remembered that none of these corrective measures will restore the original luster to the surface of the sheet. In addition, to prevent damage of the coating, chemicals such as salts, acids and alkalies, should not be used or stored in the vicinity of the coated stock storage.

Zinc coated sheet and strip usually arrives from the mill with a protective oil coating; the removal of this oil film can be accomplished by using either mineral spirits, naptha or kerosene. No water rinse is required. On a production line, the commercial type degreasing

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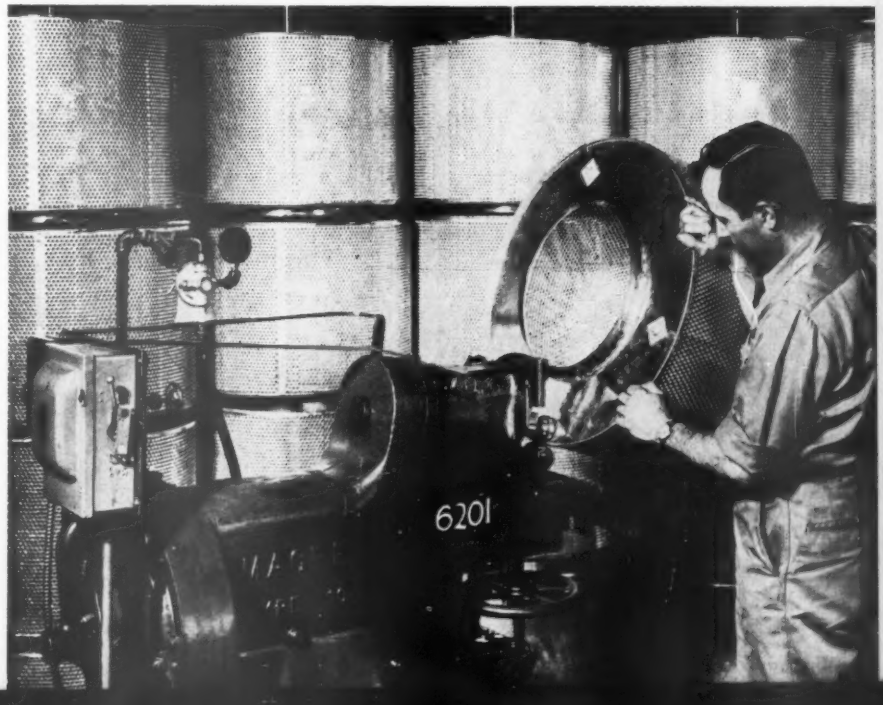

Fig. 5. Rolling a bead on rim of basket used in home laundry drier.

WHAT IS T-V DOING IN

THE applications of industrial television are growing at a rapidly accelerating pace. It is finding many jobs which it can do with more safety, at lesser cost, and with greater accuracy and dependability than when those jobs are entrusted to human hands.

As compared to broadcast or entertainment T-V, industrial television is a closed-circuit setup. That means that the transmitter (the camera) and the receiver (with its viewing screen) are connected by a cable. The camera and receiver may be several thousand feet apart without affecting the clarity or definition of the image as seen on the viewing screen.

In as much as the camera itself can be located in greater proximity to high temperature sources and hazardous operations than is tolerable for human observers, closed circuit television permits seeing at a distance those processes which could not be viewed closeup with safety.

A great deal of pioneering use of closed-circuit television in industry has been sparked by the Diamond Power Specialty Corporation, manufacturers of such power plant equipment as soot blowers, deslagging equipment and boiler gauge glasses. They have many installations of the "Utiliscope" equipment for such applications as checking remote gauge readings,watching the flow of molten steel, viewing

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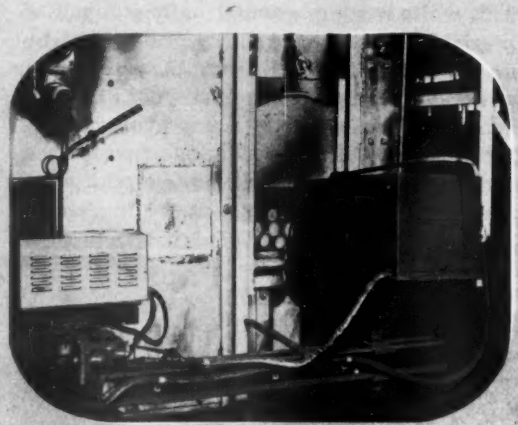
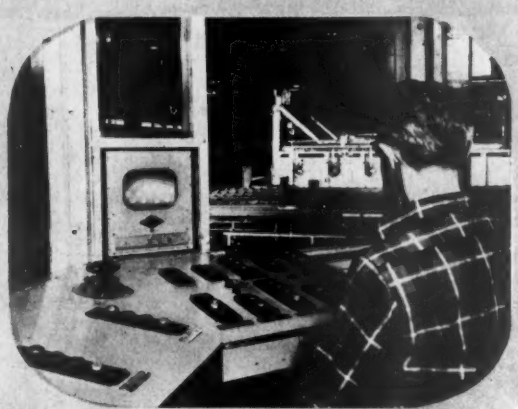


The camera gives the dispatcher a picture of the movement of the tubes through the furnace so he can control the mill conveyor speed to avoid "pile-ups" within the furnace.

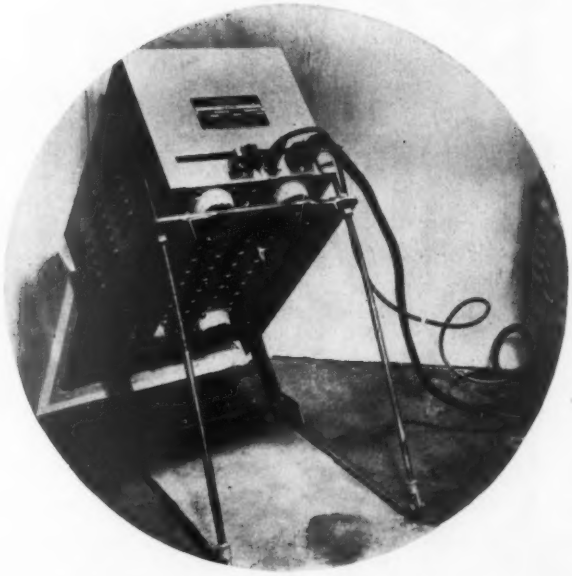


At Timken Roller Bearing Company's seamless tube mill both the heating furnace and the mill are controlled by one dispatcher plus "Utiliscope" camera and monitor screen.

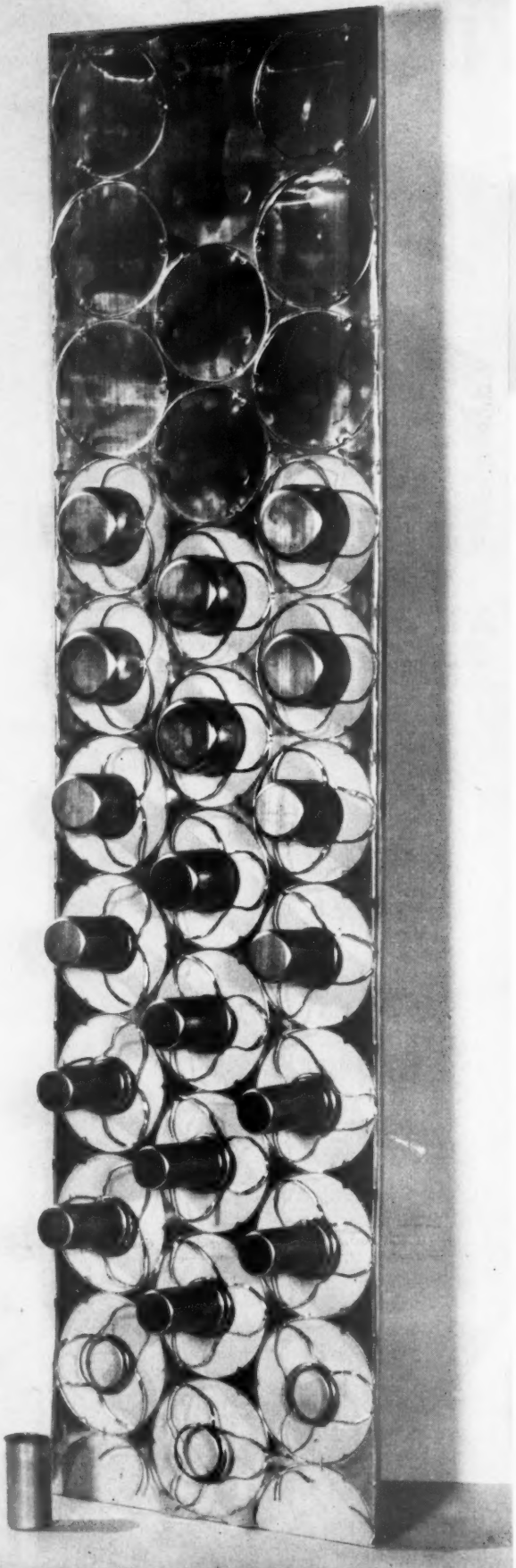
INDUSTRY?

With this view on his I T-V screen of the filling of the car, he regulates conveyor speed, shifts car position as filling progresses, and moves next car into position.

The operator of this Logemann scrap baler inside Ford Motor Company's Buffalo stamping plant sees, on his "Utiliscope" screen, the outdoor loading of the railroad car.



At the far end of the line, the "Utiliscope" camera is mounted in the conveyor structure so as to focus on the loading chute and car interior. With this I T-V installation the baling press operator no longer depends on signals from a spotter outside the building.



UNCONVENTIONAL EXTRA-

WITHIN RECENT YEARS, the practice of drawing deep shells by successive operations in a single progressive die has become fairly well known. In a unique departure from the conventional, the "triple-multiple" die described here has been developed to make extra-deep draws in a single die. This die produces, in a most unorthodox manner, three identical finished shells at each stroke of the press.

Shown in the panel to the left, the stock strip indicates the progression of the draw. Shown in Figure 1, the cutout pattern (blank and carrying strip) is the double round type, notched to carry the part by the "three-leaf clover" method. Study of the pattern in Figure 1 will show that the double-round cutout consists of two incomplete blank contours. The outer blank becomes the web suspension for carrying the part as it is drawn. The inner blank supplies the material needed for the finish drawn shape.

Unique in this die, the double round is prepared complete in the first station by the use of a compound punch and die. This, naturally, insures positive equalization of the web or carrying strip surrounding the blank. This is necessary in order to avoid unequal directional pull of the web in the first draw station.

Another trick that contributes much to the successful performance of the die is the provision of three equally spaced "V" tabs in the

The strip displayed at the left shows the sequence of operations. From the top: (1) Double round cutout in the two outer rows; (2) Double round cutout in the center row; (3) Idle; (4) First draw, or cupping; (5) Idle, see text explanation; (6) Redraw; (7) Redraw; (8) Redraw; (9) Thread lip, and (10) Blank shell from the web. Note how strength is provided for die sections in the first three stations.

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AUTOMATIC DIE DRAWS DEEP SHELLS EFFICIENTLY

outside blank. This is necessary in order to prevent breakage of the web, permitting the carrying web movement without crowding in the environs of the web connections to the cup, in the deep drawing station. This is very important and is worth close scrutiny of the illustrations in order to grasp its true value and significance. In general, this provision is required only for extra-deep drawpieces.

Compound Cutout Shortens the Die

A cutout prepared complete in one station is ideally suited for light-gauge materials, because stripping the material from the punch and die creates no difficult problems. Light duty springs will suffice as a pressure medium.

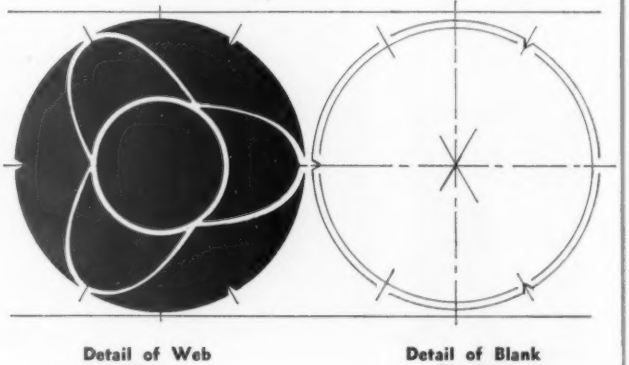
In addition, the compound cutout—by saving an operation—permits shortening the over-all length of the die. The double round type of cutout is customarily cut in two stations, with an idle station between to provide strength.

Cylinders Give Precise Pressure Control

Each of the four successive drawing operations (12 individual stations) requires an air cylinder, as a controllable pressure medium to apply the exact amount of pressure required to draw the shape without rupture or wrinkles. As shown in Figure 2, these cylinders are mounted on the upper platen; cushion faces contact the pressure pins which are secured to the pressure pads.

In the first draw (cupping) station, a simple draw pressure pad is mounted individually around each of the three first-draw punches on the upper part of the die. See Figure 3. During the action of the press stroke, these pressure pads contact the cutout area and re-

"THREE-LEAF CLOVER" CUTOUT



Detail of Web after Drawing and Blanking

Detail of Blank Showing Tabs and Connections

Fig. 1. The double-round cutout pattern shown to the far right provides for carrying the part successfully as the extra-deep draw is developed. The secret of success, where draw is severe, is the provision of the "V" tabs in the outer blank.

strain the outer metal against the lower die; and, as the press completes its stroke, the cup is drawn.

"Idle" Station Serves as Pilot

In the station immediately following the first draw, no punch is required. An opening, however, is provided in the lower die to receive the first-drawn cups. The station serves a dual purpose. Once its function is clearly established, it is seen to be the means of applying pressure on the flat strip in the first-draw station while, at the same instant, having a drawn cup resting on the redraw station without loss of pitch.

The first purpose of this opening in the lower die is to serve as a pilot in the starting of the strip. It positions the first-drawn cup, which in turn positions the cutout exactly over the first-draw station. Even though an error in the pitch distance may have occurred when starting the strip, once this station has received the first cup drawn, material will be advanced by exactly the specified pitch disance at every hit.

The second and most important function this station serves is to lengthen the angular distance from the top of the drawn cup resting on the redraw station to the flat strip resting on the die under the pressure pad at the first-draw station. The angle assumed by the strip at this moment of full contact, as the press strokes, is critical. Too steep an angle will cause binding of the strip between adjacent stations. The proper angle will prevent this trouble. Sometimes, it is necessary to employ two or more of these "dummy" stations to achieve this result. This station contributes nothing to the functional development of the piece part, but is an absolute requisite in its contribution to the functional operation of the die.

Redraw Pads Made to Slip Fit

The next three operations in the die are reduction-draw stations, which reduce the shell body to its finished size. The pressure pads (or sleeves) used in these operations are made to a slip fit around the punches, while the outside of the pads are made to slip fit into the cup to

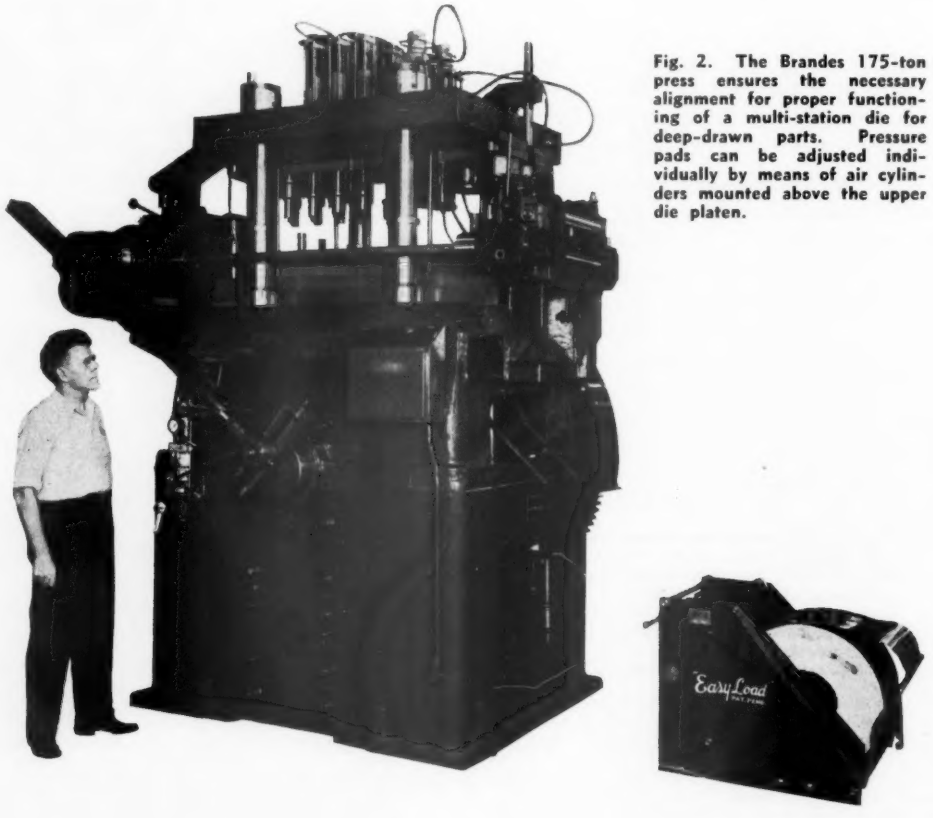


Fig. 2. The Brandes 175-ton press ensures the necessary alignment for proper functioning of a multi-station die for deep-drawn parts. Pressure pads can be adjusted individually by means of air cylinders mounted above the upper die platen.

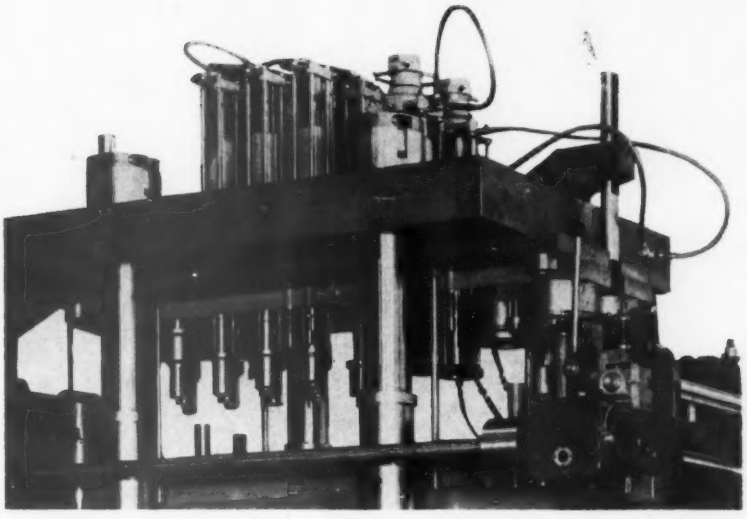


Fig. 3. Push rods mounted along the outside of the die depress a long plate beneath the die on which the individual station lifting pads are mounted. Push rods are not fastened to the spring-loaded plate and function only during a small increment of the press stroke.

be redrawn. These pads perform four objectives:

1. They pilot to insure a precise centering of the cup to be redrawn.
2. They apply pressure against the cup and the redraw radius of the die.
3. They prevent the cups from leaving the lower die until all the punches have been retracted, at which time all cups are lifted simultaneously, and,
4. They strip the redrawn cups from the punches.

Strip Is Lifted Uniformly

The lifting of the cups out of the lower die is accomplished by the four push rods which can be viewed on the outer part of the die (Fig. 3). The rods contact a plate which is mounted underneath the die. During the downward movement of the press ram, this plate—having a pressure medium—must recede, allowing the various individual lifting pads to follow the downward movement of this plate. The synchronization of this action is adjusted with care, for the timing must be very precise in order for the entire strip to be lifted uniformly.

In the operation following the final redraw, the lip of the shell is formed with a pitch of a thread around its periphery. In this operation, the pads simply perform a stripping function, so that only a minimum of movement is necessary. This permits the use of springs as a pressure medium.

The final operation blanks the shells, and here again the pressure pads—having very little motion—operate efficiently with springs.

The blanked shells drop through the die onto an inclined chute and slide on down into a container on the lift side of the press.

The press shown with the die in place (Figure 4) is a Brandes 175-ton, double-roll feed type dieing machine with scrap cutter. The press can be mounted on the floor level as shown; however, it would then be necessary to have a raised platform for operator convenience. It is usually more desirable to have the base of the machine setting in a pit, bringing the die level to a convenient height from the floor level. This would contribute to simpler setups and would facilitate operation and maintenance.

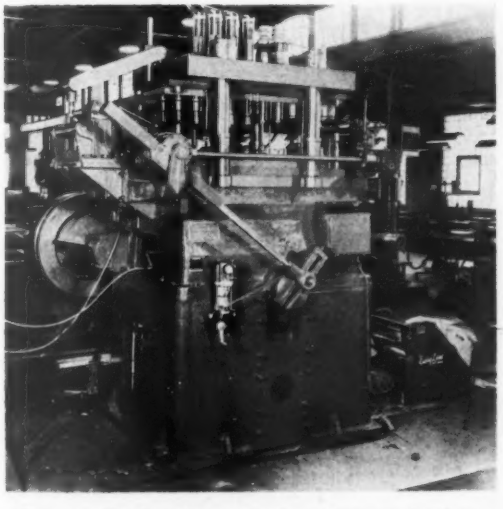


Fig. 4. The Brandes press, shown here on the floor with the die mounted for tryout, is set in a pit for production operation.

Success Of A Carbide Tool

UNTOLD QUANTITIES of effort and money have been expended in the development of new and the improvement of existing cutting tool materials. Unquestionably, the greatest step in achieving the ultimate in tool material for machining or fabrication by more conventional means was the introduction and development of sintered carbide as a tool material. With its use, greatly increased production rates were made possible.

However, because of the techniques required to produce sintered carbide and because of certain of its inherent qualities, it was necessary to depart from conventional practices with regard to tool design. And, a practice which—with wrought metal tool materials—was rather uncommon became the standard method of fabrication. We refer of course to brazed and mechanically-held tipped tools.

It is interesting to note the significance which has been attached to the design of sintered carbide tools with regard to tool geometry (e.g. rake angles, cutting angles, tip size, etc.), grinding, brazing and carbide grade selection, and the contrasting lack of attention applied to the tool support material. For example, one recently published volume having over 400 pages on the subject of sintered carbide tool design contains just two pages with reference to tool shanks. Included in those two pages are references to tool shank geometry as well as to the selection of materials.

From this and from many other references, it would seem that the tool support material played a very small part in the success or failure of a particular tool to perform and to perform economically. However, such is not the case. Quite often the improper selection of tool body or shank material is responsible for detrimental tool performance, rather than the carbide grade or machine tool upon which the failure is usually blamed.

To govern the selection of shank or cutter body material, it is necessary to analyze entirely the condition surrounding the fabrication and use of a given tool. When carbide was first introduced, this was not a very broad subject since the use of carbide was generally limited to lathe applications in conjunction with high speeds and light feeds. As a result, the loads

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transmitted to the shank were relatively light and fabricating techniques were the chief factor affecting material selection.

With improvement in techniques of manufacturing sintered carbide and the development of machine tools capable of withstanding heavier loads, the cutting tools are naturally subjected to greater abuse. Examples are found in the milling of forging die materials with tooth loads of 0.020" and the machining of manganese rail car wheels at 0.040" feed and 175 surface feet per minute. The magnitude of the loads existing at the cutting point and transmitted to the machine through the tool shank cannot be under-estimated. It is only because great care was given not only the selection of carbide grade and tool geometry and grinding but also the shank material, and its subsequent heat treatment to develop the physical properties necessary to resist those forces, that these operations are possible. The

Depends Upon Shank Selection

widely divergent applications to which carbide may now be applied no longer permit a general recommendation as was possible in the beginning.

Rather, it is necessary that the selection of shank material be governed by an engineering evaluation with primary regard to the effecting of maximum tool performance and economy. Two equally important phases must be considered. Fabrication and application are those factors.

First is the application itself. When later reviewing the fabrication, it may be necessary to modify or compromise on the selection reached in this phase to better accommodate fabrication due to available facilities or the availability of tool materials. With the wide range of tool steels now available as standard materials, it is quite possible that this modification or compromise may be accomplished without sacrificing tool performance and economy.

Initial consideration must be given to the type of tool to be selected e.g., brazed or mechanically-held, as shown in Figure 1. The chart in Figure 2 may aid or be used as a guide in determining which type should prove most desirable. Quite naturally the selection of shank materials for either of the two types may be quite diverse. When mechanically-held tools are used, the shank may be heat treated to provide the necessary physical qualifications. It is not a rapidly expended item; consequently, greater material cost can be tolerated and more time utilized in its construction. On the other hand, brazed tools are expended with each use and this must be given due consideration. In addition, the brazed style dictates that some importance be attached to the brazing qualities of the shank material.

Although the above will influence the final selection, certain basic requirements must be satisfied for both types. Certain of these may be satisfied by physical properties which are influenced by chemistry, geometry, and/or

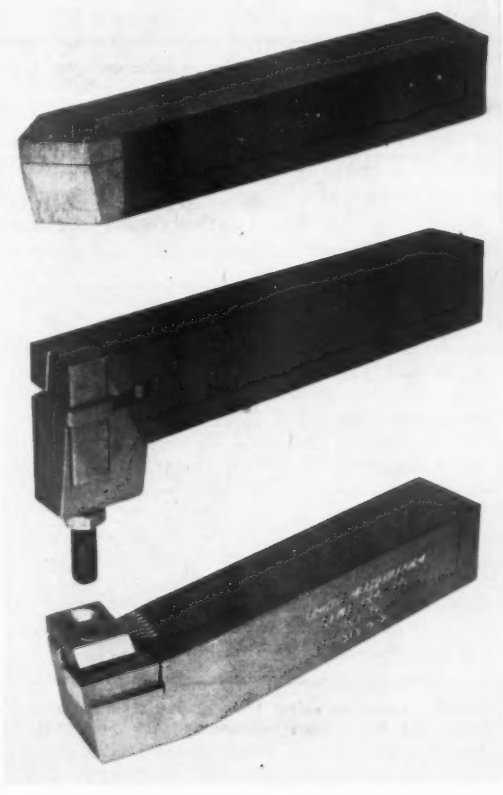

Fig. 1. Three single-point tools — conventional brazed, the Mechanigript, and the Mechaniclampt. These basic methods of holding a relatively small tip or insert are also employed in other types of tools.

BASIC TOOL TYPES

BRAZED		MECHANIGRIPT		MECHANICLAMPT	
Application	**Advantages**	**Application**	**Advantages**	**Application**	**Advantages**
Applications where tool shank dimensions must be held to 1" sq. or less	Smaller shanks reduce both steel and carbide requirements	High speed, light machining of ferrous alloys	Minimum downtime for tool changing. Minimum of adjustment required during operation	Heavy duty, slower speed machining of all materials. General shop equipment	Two - way adjustment for minimum carbide removal per quantity of material machined
			As high as 8 cutting edges made available per grind. Reduces grinding time and tool material consumed per quantity of material removed		Reduces thermal strains caused by high temperatures generated in slow speed, heavy feed machining
Cut-off tools, form tools, and others where tool design requirements do not facilitate mechanical holding	Smaller tips may be used than can be accommodated in mechanically - held tools	Repetitive operations in high production shops on automatic and semi-automatic machinery	Eliminates strains due to grinding	Machining of tough strain - hardening materials such as armor plate, manganese steels, and high temperature jet alloys	Reduces thermal strains caused by grinding. Provides added strength in tool body to withstand heavy cutting forces
	Operations that can not be performed with mechanically-held tools may be done economically		Eliminates strains caused by difference in thermal expansion resulting from heat generated in cutting and brazing process		
Occasional or non-repetitive work when large tool bodies are required			Eliminates maintenance equipment for brazing and servicing of shanks		Tool bodies are non-expendable. Permits the use of harder and more wear resistant grades of carbide
			Reduces inventories of tool and shank materials		
			Permits the use of harder and more wear resistant grades of carbide		
Machining of highly ductile materials requiring positive rakes and greater clearances			Tool bodies are non-expendable		Uses standard stocked rectangular blanks

Fig. 2. The choice of basic tool type requires consideration of the specific application.

	MASS	CHEMISTRY & HEAT TREATMENT	GENERAL DESIGN
DEFLECTION	√		√
STRESS CONCENTRATION	√		√
FATIGUE STRENGTH		√	
NOTCH SENSITIVITY		√	
YIELD STRENGTH		√	
ELASTIC LIMIT		√	
HARDNESS		√	
DEFORMATION	√	√	√
SHEAR STRENGTH		√	

Fig. 3. Shank or cutter body properties of importance, and the factors influencing such properties.

heat treatment given the material and others by geometry alone.

When the application is known and production requirements as to quantity, accuracy, and so on have been determined, tool loads may then be computed or estimated. Initial investigation should be directed toward a strength of materials or structural analysis. Equally important are mechanics and physical properties. Subjects of individual consideration are deflection, rigidity, deformation, strength, and fatigue.

Because of the natural complexity of the subject and publication space limitations, rather than discuss in detail each of these elements, the chart in Figure 3 was designed to show the principal factors relative to application requirements and the corresponding subjects which will influence the selection. Figure 4 indicates fabrication considerations and their influencing factors.

For practical consideration, a review of available materials suggests that one of several general classifications might be selected. In-

	MASS	CHEMISTRY & HEAT TREATMENT	GENERAL DESIGN
MATERIAL COST	√	√	√
MACHINABILITY		√	
BRAZING		√	
GRINDING	√	√	
SALVAGE		√	

Fig. 4. Factors influencing tool fabrication.

cluded are the plain carbon series of steels, alloy steels, high speed steels, sintered carbide, cast iron, nickel alloy or nodular iron, and invar. Each of those mentioned have both desirable and undesirable characteristics, and the individual application will determine a balance which best suits the conditions surrounding a given application. A table listing of these materials and their inherent principal advantages and disadvantages is shown in Figure 5.

Of prime importance to any tooling application is the effecting of maximum economy and performance. In the case of brazed tooling particularly, many of the requirements may be satisfied by the use of plain carbon steels. The exact choice, however, should be governed by the material which will best fit the requirements of both application and fabrication. For example, it may be necessary because of the application to specify copper as a brazing medium if a brazed style of tool is desired.

Because of the temperatures involved in copper brazing, it would be apropos to select SAE 1095 to prevent grain growth in the steel, as well as to provide minimum distortion. However, because of production requirements and the necessity of removing worn or broken tips, remachining and retipping, the cost of annealing between uses may result in excessive tool costs. It is necessary then to determine whether — because of the application, the choice of carbide grade, or other factors — it is possible to substitute an alloy steel or lower carbon steel to justify the brazed-tool design, or whether general design should be modified to permit the use of a mechanically-held style tool.

To aid in the choice of a plain carbon steel which best fulfills individual requirements, the chart in Figure 6 shows the influence of carbon content on the tensile and yield strength. If it is desired to impart additional strength or hardness to a section or to the entire tool during or after brazing, a general rule with reference to carbon content and the type of quench permissible is:—

MATERIAL	PRINCIPAL ADVANTAGES	PRINCIPAL DISADVANTAGES
Carbon Steel	Economy Availability Brazability (High Carbon) Aorasion Resistant	Carbon Content controls physical properties
Alloy Steel	High Strength Forgability Ease of Heat Treatment	Cost Availability
High Speed Steel	Non-Deforming Stability High Hardness & Strength Wear Resistant	Availability Cost Heat Treatment Special Brazing Req'd.
Sintered Carbide	Rigidity (High Young's Modulus) High Compressive Strength High Hardness Low Thermal Expansion	Cost Low Shear Strength
Cast Iron	Dampening Effect May be Cast Close to Size	Low Young's Modulus Strength
Nickel Alloy & Nodular Iron		Availability Strength
Invar	Low Thermal Expansion	Availability

Fig. 5. Principal shank and cutter body materials.

1. Water quench — 0.030 to 0.040 carbon
2. Oil quench — 0.045 to 0.070 carbon
3. Air quench — 0.060 to 0.095 carbon

If the subject tool and strength and economic considerations require that a forging be utilized, the carbon content of a steel should be maintained between 0.030 to 0.040 and additional strength requirements furnished by the choice of an alloy tool steel.

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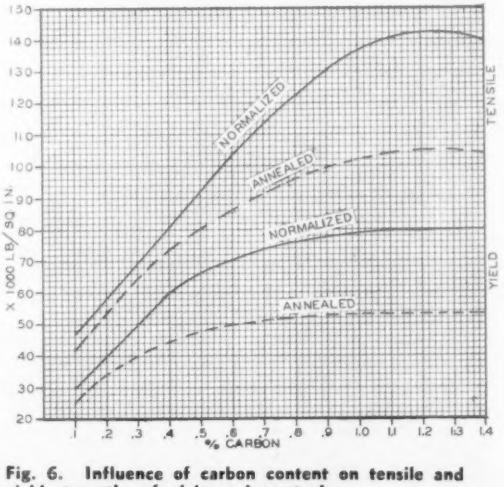


Fig. 6. Influence of carbon content on tensile and yield strengths of plain carbon steel.

TRANSFER PRESS PRODUCTION OF A LAMP BODY

THE transfer press tooling for the production of an automobile side-lamp body on a Schuler press involves fourteen stations. This job, run by Joseph Lucas, Ltd., Birmingham, England, is typical of the economies in floor space and number of operations which can be effected by transfer press methods. The accompanying reduction in work handling results in savings in storage space and production accounting.

Schuler presses have capacities of 40, 80, 160 and 250 tons, with eight to fourteen tool stations on the smaller, and eight to twelve stations on the larger sizes. The work-material is delivered to the press as coiled strip, Figure 2, or as previously cut blanks, and generally leaves the machine as a completed pressing, ready for subsequent surface finishing and assembly operations.

An even work temperature is maintained by the rapid transfer of the pressings between successive tool stations. The hardening effect due to the cooling that takes place between operations, when individual presses are employed, is thereby eliminated. Deep drawn components which would usually require three annealing operations can be produced in a single cycle of the transfer press.

Further economies may be effected by the incorporation of beading and thread-rolling tools in the setup, so that secondary operations are reduced to a minimum.

Although coiled strip is generally employed on these machines, previously prepared blanks can be used when a feeding attachment provided with a suction device is fitted. The work-material can be fed from both ends of the press

Fig. 2. A 40-ton Schuler transfer press was tooled for drawing the brass shell.

Fig. 1. The successive stages of representative workpieces as produced in single work cycles on the transfer press. At "A" is the lamp body subject of this tooling article.

and ejected from the central tool stations, thus permitting twice the output-rate. Alternatively, two different components can be produced in a single cycle of the machine. Transfer presses are especially suitable for high production, and are not generally recommended for batches of less than 100,000 parts.

The parts shown in Figure 1 are typical of the work done on Schuler transfer machines, and the intermediate operations in their manufacture can be clearly seen. An elliptical flask B is assembled from the adjacent body and top, which are made with separate press setups. The ornamental base C is of considerable interest, since the square cross-section of the component is drawn in seven stages from a circular blank. Three further operations for piercing and trimming complete this component. A large parabolic reflector D and the pressing shown at E are formed without intermediate annealing, and provide further examples of difficult drawing operations in addition to the side-lamp body shown at A.

A drawing of the side-lamp body is given in Figure 3. Brass strip of BSS. 568 is employed, and the body is subsequently chromium plated and polished. It is essential that the external surfaces should be free from tool marks, since the automatic polishing operations do not permit any dwell for the removal of blemishes.

The body is complete as it leaves the transfer press with the exception of the holes in the periphery. Noteworthy among the operations performed is the reduction of the mouth of the drawn shell whereby a seating is formed for the lamp-glass rim.

Fourteen operations are performed on the

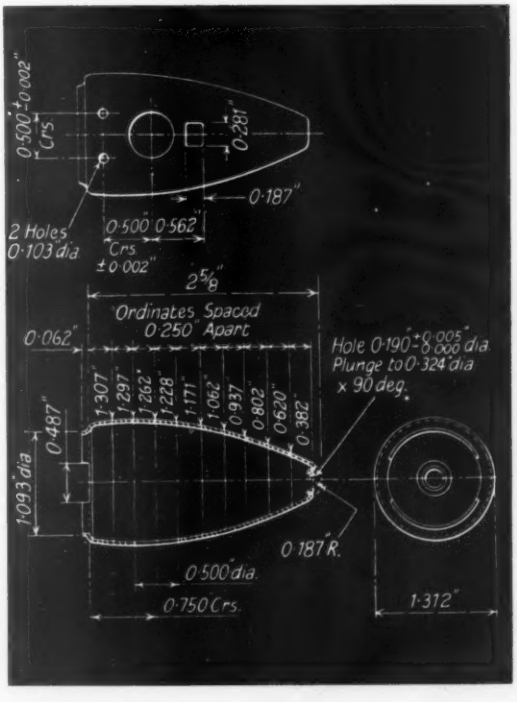


Fig. 3. Except for the peripheral holes, the Lucas side-lamp body is produced complete by transfer press tooling.

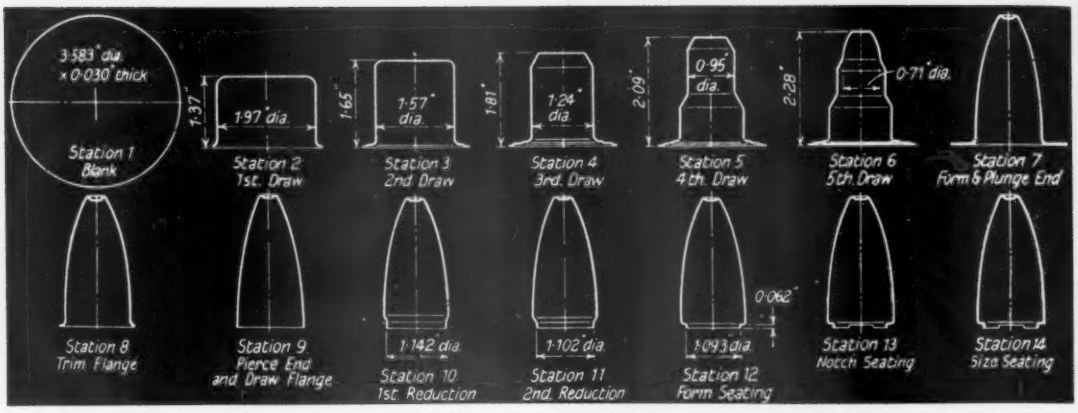


Fig. 4. The shape of the workpiece at each of the 14 stages of press production.

press, and the shape of the component at each stage is indicated in Figure 4. An attachment reciprocates the blanking tool so that two blanks are cut from a 7 in. wide strip of material, 0.030 in. thick. The blanks are fed by a slide to the first pair of jaws fitted to the transfer mechanism, and thence to the first drawing tool. After the shell-like profile has been formed at station 7, the flange is trimmed by the tool at station 8, leaving a flared end which is drawn to form the profile shown at station 9. The piercing of the 0.190 in. diameter hole in the small end is also performed at this station. Three reducing operations follow, for forming the 1.093 in. diameter, and two horizontal notching punches, in the tool at station 13, produce the 0.487 in. wide slots in the seating flange. The work cycle is completed by a sizing operation for the seating and slots, in the tool at station 14.

The final sizing tool is not shown in the close-up view of the tooling area of the press, Figure 5. At A are housed feeding and straightening rolls for the strip, and at B are seen the gripping jaws on the transfer rods at the front and rear of the tools. Twelve air-cushions are incorporated for the lower tools, and the control valves, pressure gauges, and regulators for the cushions are fitted at the front of the machine bed.

With the exception of the first drawing tool, which incorporates a nest for the blank, the top face of each lower tool presents a flush surface when the tool is at the upper limit of its movement.

A constant tool height is maintained throughout the machine, thereby facilitating the transfer of the workpieces between successive stations. As the transfer jaws withdraw, the components are retained in the vertical position by a spring-loaded plunger fitted in the center of each upper tool.

A similar construction is employed for the draw tools at stations 2 to 6, the fourth draw tool being shown in Figure 6. The nest fitted to the first draw tool is provided with slots for the passage of the component after the drawing operation. Pressure on the blank is maintained by the face of the drawing die in the upper tool acting against a plate in the lower tool, similar to A, Figure 6, so that a pressure-sleeve, corresponding to B, Figure 6, is unnecessary

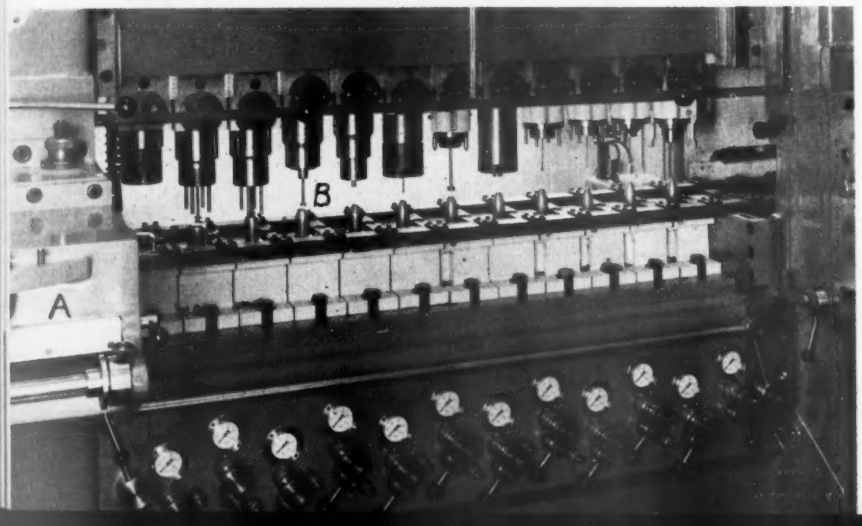


Fig. 5. This close-up view shows tooling area of the Schuler press. The plungers, which project from the upper tools, locate the work at each station upon withdrawal of the transfer jaws.

for the first drawing operation.

In the tools that follow, the plate A, Figure 6, is depressed as the top tool descends, until the workpiece is located on the sleeve B. With further downward movement, the component is drawn over the fixed punch D by the action of the die E. The flow of the work material during this operation is controlled by the pressure which is exerted by the air cushion on the drawing-sleeve B.

During the return stroke of the press, the drawn shell is stripped from the punch by the upward movement of the sleeve B, and ejected from the die by the spring-loaded ejector C.

At station 7, a fixed form punch is incorporated in the lower tool, and a forming die in the upper tool. As the ram approaches the bottom of its stroke, the flange of the workpiece is planished between the die and a pressure plate similar to that at A, Figure 6, actuated by an air-cushion. The location plunger in the top tool has a flat end and is fitted with a spring-loaded sleeve. These members form a solid punch, which "plunges" the small end of the component as the ram descends, and ejects the workpiece from the top tool, when the operation has been completed.

Mounted at station 8 is the trimming tool shown in Figure 7. The spring-loaded plunger A retains the workpiece on the fixed punch B, until it is located by the stripper C, as the ram descends. After the flange has been trimmed by the die D, the ring of waste material is carried downwards by the die and severed by the two chisel-like blades E, fitted to the punch. Consequently, the two pieces of waste can fall clear, on either side of the cross-member which supports the punch assembly.

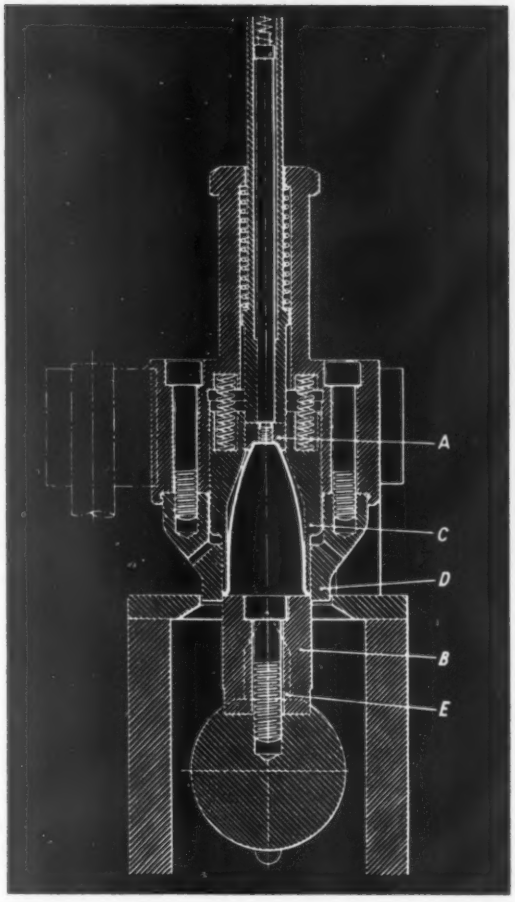
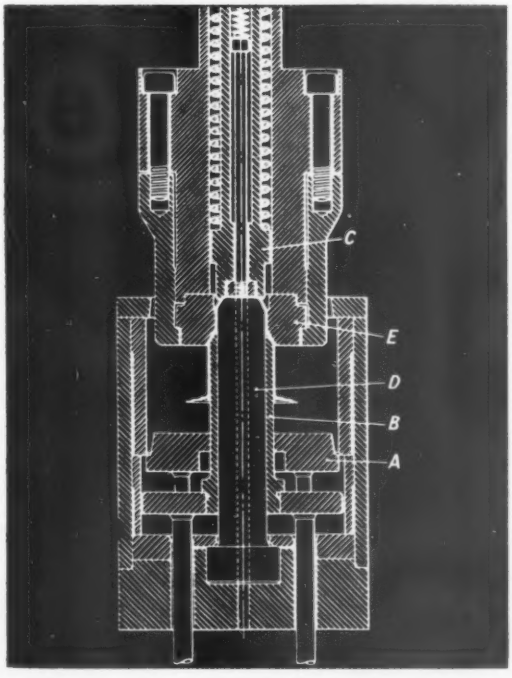


Fig. 7. The body flange is trimmed by this tooling at station 8.

Fig. 6. Sectional view of the draw tooling for station 5.



A piercing punch for the 0.190 in. diameter hole in the small end of the component is mounted in the upper tool at station 9. This tool draws the flared end of the workpiece into a parallel, cylindrical form over a fixed punch in the lower tool. A removable piercing die is fitted to the top of this punch, the slugs of waste material passing down a clearance hole in the center of the punch assembly. Surrounding the piercing punch is a stripper sleeve which is fitted with a three-legged "spider" at its upper end. Pressure is transmitted to the "spider" by three pins, from a spring and plunger in the hollow body of the top tool. The sleeve serves to locate the component from the previously "plunged" recess, as the ram descends, and before the piercing takes place.

. . . *Continued on page 72*

The North American F-100 Super Sabre, new air superiority fighter, which uses titanium extensively throughout plane

TITANIUM

. . . the Metal of 1954?

PART TWO OF TWO PARTS

Welding

Much experimentation is still going on in the welding of titanium alloys. Because of the high absorption properties of the molten metal, the welding area must be protected from the normal atmosphere by one means or another. Some success has been attained in flash welding simply because of the rapidity of the process. The weld is cool and protected before the surrounding gases have a chance to enter. Plain spot welds or fusion welds are well exposed to the atmosphere, and the resulting brittleness of the weld metal makes them useless. If an inert gas shielding such as helium or argon is used, satisfactory welds can be produced. Heliarc butt-welding has shown a degree of success. All welding should be followed by annealing at 1200° to 1300° F. Ti-75A retains most of its ductility after welding, but Ti-150A tends to quench harden.

by Elmer H. Hahn, Jr.
Registered Professional Engineer
Cleveland, Ohio

Brazing and hard soldering is possible with titanium, if again an inert atmosphere is provided. Successful brazing has been accomplished with nickel and copper alloy solder. The Superior Tube Co. has produced brazed tubing by a special process. North American Aviation, Inc. has successfully used silver solder to seal titanium spheres containing mechanisms requiring protection against atmospheric conditions, chemical attack, or leakage of lubricating fluids.

Grinding

The grinding of titanium is similar to the grinding of stainless steel, but because of less experience this operation can be quite troublesome. Because of the low thermal conductivity of the metal, much heat is evolved at the grinding surface. Added to this feature is the chemical attack of hot titanium on the grinding wheel material (the same reaction which molten titanium has upon refractories). Earlier attempts reported grinding wheel wear as high as three times that of the metal. The Norton Company has published a report based upon an extensive grinding study. Wheel wear

has been cut to about a one-to-one ratio. Recommended abrasives are aluminum oxide, silicon carbide, and diamond. Apparently the most important rule to follow is slower grinding speeds (about half the speed used for steel), and use of a coolant wherever possible. On major grinding operations, the work should be periodically stress-relieved at 1200° F to prevent cracks.

Machining

As might be expected, a great deal of controversy exists at present regarding machining techniques. Machinists report both good and bad results even when the same alloys and tools are used. It is evident that special precautions must be observed with titanium, much the same as with many other commercial metals. The technique is very similar to that used for alloy steels, and may be applied to titanium with little change. Slow, heavy cuts are recommended, but as experience on a particular operation is gained, speed and cut may be adjusted somewhat. While no particular cutting fluids or coolants are generally recommended, the supply of fluid must be adequate at all times. Tool breakage is mainly caused by dryness at the cutting edge and the welding of chips.

Early experience with alloy titanium indicated that carbide tools were entirely unsuited to this metal. It was assumed that reaction

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Titanium Forging Requirements

BURSTING TESTS on dimensionally identical titanium disks (compressor wheel forgings) have shown a broad range of speeds for bursting. This has been accounted for largely by differences in ductility. Unless a highly stressed part can locally readjust itself by plastic deformation, stresses rise locally to the fracture level at bearing points and section changes.

The ductility found in a titanium wheel forging is a result of both composition and history of the metal. Composition affects ductility more through variations within an alloy than through contrast between alloys. The heating and working schedules during forging also affect ductility. For instance, the Cr-Fe-Ti alloys exhibit a grain boundary brittleness after heating above 1650° F. The large grains resulting from high heating appear to be ductile, but the fractures are nearly 100% intergranular. A constituent is evidently ejected by the beta grains to the boundary region where it causes brittleness.

Brittleness from heating to the all-beta region is the usual case. Minor variations, probably in composition, have occasionally permitted heating to the all-beta range without embrittlement. If a large forging reduction is made while the titanium alloy is cooling down to the alpha-beta range, the beta boundaries are broken up and ductility is restored to the finished forging even if heated above 1900°.

Many of our earlier disk forgings were made with several reheatings in the vicinity of 1800° F. Most of these exhibited the intergranular brittleness; some were much worse than others. It is our belief that the beta boundary brittleness is caused by an element not listed in the nominal compositions of the alloys.

In the case of disk forgings, the billets must be clean inside and outside. Discontinuities such as tungsten or graphite inclusions or segregations from incomplete fusion of alloy additions can dangerously lower ductility in local regions. Our tests have shown definitely that broken tungsten particles seriously lower elongations. Again, titanium melted under graphite electrodes has shown regional deficiencies in ductility.

Practical fabrication of wheels from forgings will depend on machining techniques to be developed further. Rough machining would be greatly aided by a method of removing the forging surface before actual machining was started. The case hardened layer below the forging scale probably causes more grief to machinists than any other single factor.

Another interesting application of titanium forgings is its possible use in compressor casings. Several designs calling for forming and welding have been suggested. However, we know of no method to produce ductile fusion welds in the higher strength titanium alloys. Meanwhile, we are making casings by rolling up slabs of titanium alloy and machining the desired contours.

Surface quality is important since the outer surface is stretched during forming and the inner surface must clean up to accurate dimensions without too much waste of material. The machining of the casing is admittedly a terrific job. Contour forging of the outside of the casing will make the fabrication more practical.

There are many minor details to be satisfied in forged (compressor) blades for jet engines. The final blade finish will depend on such factors as segregation in the bar, heating time and temperature, smoothness and cleanliness of forging dies, amount of surface removal in descaling, grinding operations, and final surface finishing operation. The dies for compressor blades are generally rather precise and must be filled completely to produce dimensionally accurate blades.

The cost of titanium blades is not so far out of line as the larger forgings for wheels and casings. Forging operations on the blades are so many that material becomes a smaller fraction of the total cost. However, there is certainly room for a large cost reduction by some process such as the Delco-Remy blade rolling.

Gears will undoubtedly require more successful hard surfacing than has been produced to date. But there are several promising prospects in hard surfacing. If a plating is used, there is no doubt that it will have to be backed up by one of the harder titanium alloys.

—L. R. Frazier, Metallurgical Eng'r
General Electric Co., Lynn, Mass.

Portable rough grinding of titanium in Carborundum's Mechanical Laboratory. All possible variables in technique and abrasive specifications are investigated, and those which are most promising are tested in the field under production conditions.

Abrasive Action in

TITANIUM GRINDING

by Fred A. Upper
Manager, Sales Engineering
Bonded Products & Grain Div'n.
THE CARBORUNDUM COMPANY
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METALLURGICAL PROPERTIES of titanium that make it and its alloys outstanding, also make it difficult to grind. Some of these are:

1. High strength causes it to resist shearing action.

2. Ductility causes it to smear and load into the pores of the grinding wheel.

3. Poor heat conductivity; does not dissipate heat.

4. Corrosion resistance contributes to a tendency to gall or cold weld to abrasive grains due to the lack of anti-weld contamination of the surface of the chips.

Early grinding tests revealed that the use of conventional abrasives and methods produced less efficient results than were obtained on other stainless metals. This is due partly to the fact that the metal is subject to embrittlement if overheated, which necessitates the use of soft grade abrasive wheels even on heavy stock removal operations.

Many special abrasive wheels were tried in the laboratory in attempts to obtain greater grinding efficiency, particularly to increase wheel life without overheating the metal. Also, many grinding fluids and techniques have been investigated. The results showed only marginal difference between the various types of abrasives and bonds.

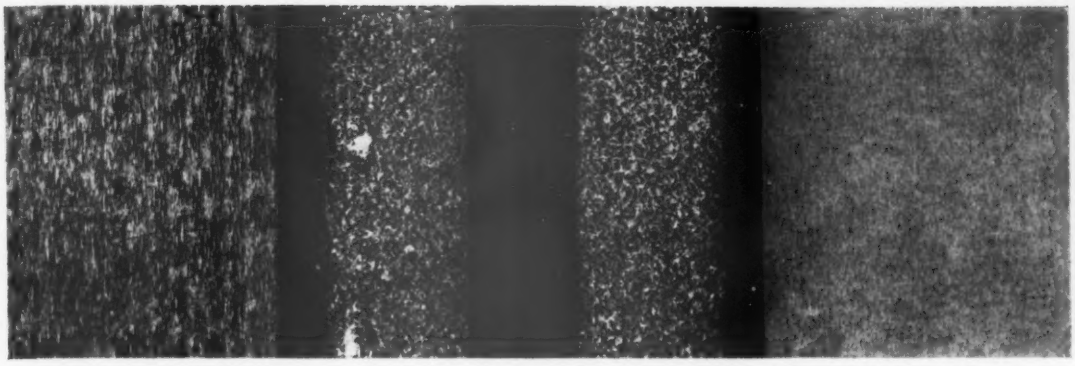
of the carbide with titanium could not be prevented due to the low heat conductivity of the metal, thus causing embrittlement of the tool. Recent experience has reversed the thinking completely however. For roughing cuts, a straight tungsten carbide tool can be used at 60 fpm, 0.015″ feed, and 3/16″ depth of cut. Straight carbide tools may be used for finish cuts at a speed of 185 fpm, and ⅛″ depth of cut. It now appears that the same speeds may be used as with 18-8 stainless steels. For longer life of carbide tools, a chromium plating will prevent titanium amalgamation on the edge.

The best cutting tools for titanium are cobalt base, high chromium alloys. Metal does not build up on the edge, and normal wear can be expected. These cobalt chrome alloy tool steels are probably also the best suited for milling cutters or cutter teeth.

Experiments have shown that at temperatures in the range —65° to —100° F titanium will machine like brass. Except for very special operations, however, practical considerations will doubtless rule out such drastic steps as directing supercooled gas against the work, or completely submerging the work in liquid air.

For drilling, reaming, and tapping, the same precautions must be observed as with stainless steel. The tools must be sharp and accurately ground, and adequate coolant must be supplied. A positive cut should be maintained at all times when the tool is in contact with the work.

Since titanium is tough and tenacious in all fabricated forms, sawing is not straight-forward. The main precaution is to prevent work hardening by not allowing the saw to ride on the work. A heavy, positive cut must be maintained, and adequate cooling and lubrication must be provided. With special care employed, good results are reported using band saws, hack saws, and circular saws. In special cases, friction sawing has proved successful.



Metal and grinding wheel surface comparison between dry and wet surface grinding of titanium. Note the marked degree of wheel loading and accompanying rough metal finish resulting from dry grinding (left). The improved finish and lack of wheel loading (right) is accomplished with the use of sodium nitrite solution applied as a mist.

The use of a grinding fluid consisting of a 5% solution of sodium nitrite in water, however, showed a marked increase in grinding efficiency. This has been verified in actual practice in the field.

Recommendations for Various Operations

1. For rough grinding operations such as those performed on sheet bar, resinoid bonded wheels should be used at a speed of 9500 sfpm. A mixture of silicon carbide and aluminum oxide in 20 grit, N grade has proved most efficient. The grinding fluid may be applied in the form of a mist blown between the wheel and the work.

2. Surface Grinding — Aluminum oxide vitrified wheels in 46 grit, L grade are recommended. Lower abrasive wheel speeds on the order of 2000 sfpm show increased efficiency and cooler cut on light cuts of .002" per pass or less. On heavier cuts, conventional speeds appear more efficient. The use of a sodium nitrite solution as a grinding fluid shows increased efficiency, cooler cuts and better finish. On machines not equipped for coolants, the mist applications may be used.

3. Cylindrical Grinding — Aluminum oxide vitrified wheels are recommended. For rough and finishing stock 1½" diameter and larger, 46 grit, 0 grade is recommended. For smaller stock, 80 grit, L grade has been satisfactory. The wheels are operated at conventional speeds with a 5% sodium nitrite and water solution as the grinding fluid.

4. Cutting Off—This operation should be performed wet. Silicon carbide rubber wheels in 60 grit and L grade have been most successful for general cutoff work. For cutting thin sections, a softer wheel grade, such as J, gives greater assurance of not overheating the work.

It is apparent that the combined efforts of the metallurgist to decrease the sensitiveness of the metal and the progress in developing better wheels by the abrasive manufacturers, plus increased grinder experience, will bring the overall cost of grinding titanium into much closer agreement with that of stainless steel.

In all sawing work, hydraulic feed mechanisms are recommended to provide a uniform positive cut. Abrasive cutoff wheels have been used in certain cases, but the metal may be discolored and an annealing treatment may be necessary for stress relief. Sawing of heavy sections is quite difficult, but flame cutting at fairly high rates of speed has proven successful. If flame cutting is used, cooling should be in air rather than liquid to prevent surface cracking.

Casting

The successful casting of titanium hinges upon a satisfactory mold material. Graphite molds have the least objectionable characteristics, but still are far from satisfactory. The carbide formed is soluble in molten titanium at elevated temperatures, but not at lower temperatures, and so forms carbide inclusions when cooled. The expense and difficulty of working graphite makes this material unsuitable to the shaping of complicated forms. Much research is being directed toward developing a suitable molding technique. Promising reports have been published by the Battelle Memorial Institute and other agencies, but the problem of producing satisfactory castings of any size and quality is far from being solved. Zirconia bonded and coated molds have reduced the objectionable characteristics of pinholing. Very recent reports, which disclose no details, state that small castings up to several pounds weight and with complex shapes have been produced with about the same quality as good sand castings of other metals. These castings are produced by means of special vacuum melting furnaces and specially prepared molds.

A second problem exists in the development of suitable casting alloys. None of the present commercial grades of titanium or its alloys can be classed as a good casting alloy. In the as-cast condition, ductility is either very low or completely absent. Some form of hot work-

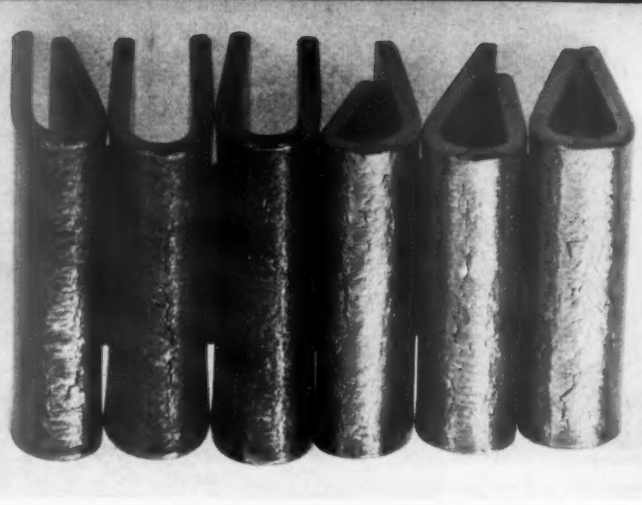


Fig. 1. Results of bending tests.

WELDING OF TITANIUM

by Francis H. Stevenson
AEROJET ENGINEERING CORP.
Azusa, California

AT AEROJET, both resistance and fusion-welding processes have been used in the fabrication of titanium. Of the fabrication processes, spot, seam, and flash welding have been used with marked success.

In spot-weld testing on commercially pure titanium (Ti-75A) of 0.063" thickness, a group of spot welds were made with both squeeze time and hold time of 20 cycles, and weld time of 2 cycles remaining constant. On an Acme 75-kva machine, various heat adjustments between 70% and 80% showed an average shear strength of nearly 2100 lbs at 76% heat, with shear strength falling below that figure for lower heating. A short welding cycle and high heat, were found to be desirable for our particular applications.

Preliminary tests indicate that resistance seam-welding of titanium will be no more difficult than the seam-welding of Type 347 stainless steel. Flash welding is used in the manufacture of titanium rings.

The only fusion-welding used is the inert-gas shielded-arc method. Successful welds have been made by manual and automatic means. All butt welds were made under actual shop conditions, using standard equipment, straight-polarity d-c water-cooled torch and cup. No basis for comparison of a-c and d-c is yet available.

In welding titanium, care must be taken so that the weld is shielded at all times, particularly until it has cooled to 400° F. Since titanium has a strong affinity for oxygen and nitrogen, proper coverage by an inert gas is most important. Speci-

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ing is necessary to break up the cast structure in order to develop the desired properties. While some experience has been gained in the handling and cooling of ingots, much remains to be learned before a good standard alloy and casting procedure can be evolved.

From the evidence available, it appears that the availability of reliable commercial castings of titanium will lag somewhat behind the other forms of this metal. It is believed, however, that demand will accelerate development of acceptable casting techniques.

Forging

Titanium has proven very promising as a forging material. The ideal forging temperatures lie in the range from 1600° to 1800° F. The metal has very good flow characteristics, and there is no critical temperature range. The metal can be cold worked and does not possess "hot-shortness". Heating can be accomplished by most conventional methods and finished forgings require no heat treatment. Sharp, clear die impressions are produced by open or closed dies.

Although titanium has its own peculiar behavior in forging, conventional methods may be followed in most cases. Being slightly more resistant to movement than steel, it has been found that repeated small reductions of titanium are better than fewer large reductions. The troublesome problem of voids in steel, which do not weld under forging but merely flatten, is absent in titanium because the voids do weld under pressure.

Frequent inspections are necessary because of the tendency to form fine surface cracks. Intermediate grinding operations will remove cracks as well as any other occasional surface defects. Any grinding operation should be followed by annealing at 1200° F to relieve stresses.

The best forging temperatures lie between 1600° and 1800° F. The metal may be worked at lower temperatures, but ductility is decreased and cracks may develop. Above 1850° F, oxygen and nitrogen absorption increases forming a harder deeper case. Grain coarsen-

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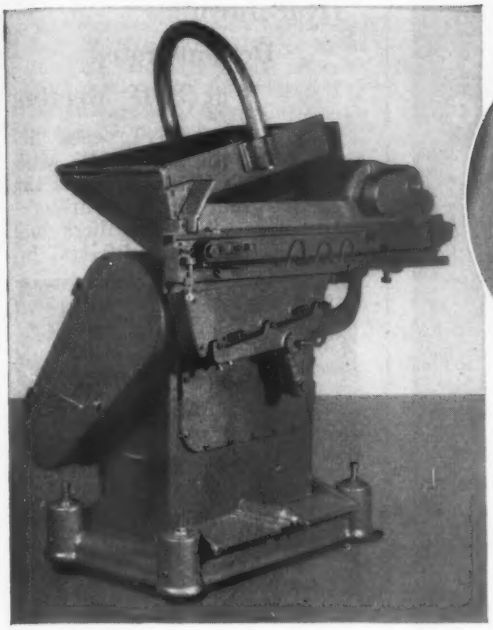
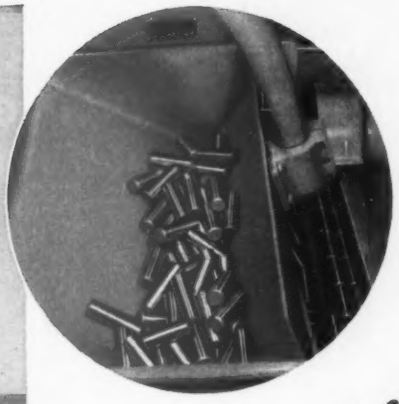
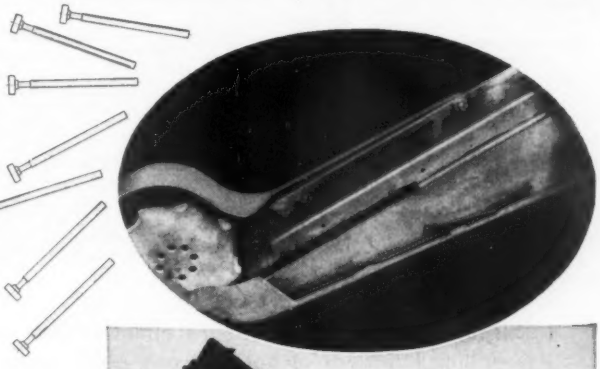


Type E Feedmatic Hopper, for thrufeed work. Capacity: work diameter, min. ¼", max. 1½" . . . length, min. ½", max. 18" . . . motor drive ½ hp.



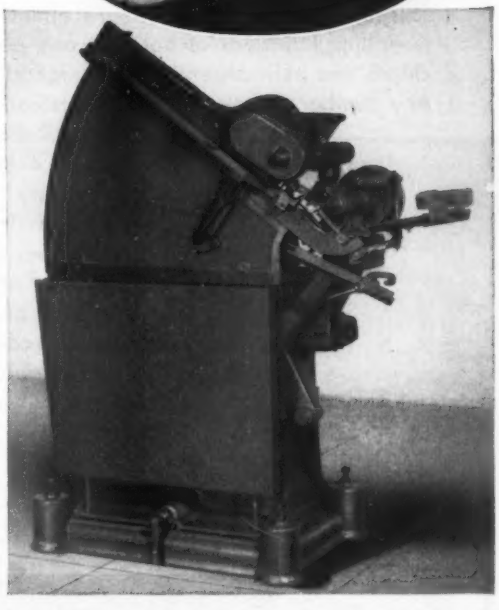
Quick Way to Mechanized Handling of Centerless Ground Work



Have you ever handled thousands of parts in the course of a brief machining operation? Feedmatic Hoppers for CINCINNATI FILMATIC Centerless Grinders eliminate this tiring and expensive handling, allowing the operator to devote his time to quality. The Hopper handles the quantity. Another advantage: it's not necessary to have continuous production of a single part; you can handle a number of long runs of similar parts with the same Hopper. ¶There are two styles of Feedmatic Hoppers . . . Type B for infeed work, and Type E for thrufeed work. Both styles can be applied to CINCINNATI FILMATIC Nos. 2 and 3 Centerless Grinders. Brief data will be found in Sweet's Machine Tool Catalog. Complete information may be obtained by writing for Feedmatic Hopper Catalog No. G-575-1.

CINCINNATI GRINDERS INCORPORATED
(Subsidiary of The Cincinnati Milling Machine Co.)
CINCINNATI 9, OHIO

Catalog No. G-575-1 contains complete details about Feedmatic Hoppers for use on CINCINNATI FILMATIC Nos. 2 and 3 Centerless Grinding Machines. Write for a copy.



Type B Feedmatic Hopper, for infeed work. Capacity: work diameter, min. stem ⅛", max. stem 1½"; min. head ¼"; max. head 2" . . . length under head, min. 1½", max. 8" . . . motor drive ½ hp.

CINCINNATI

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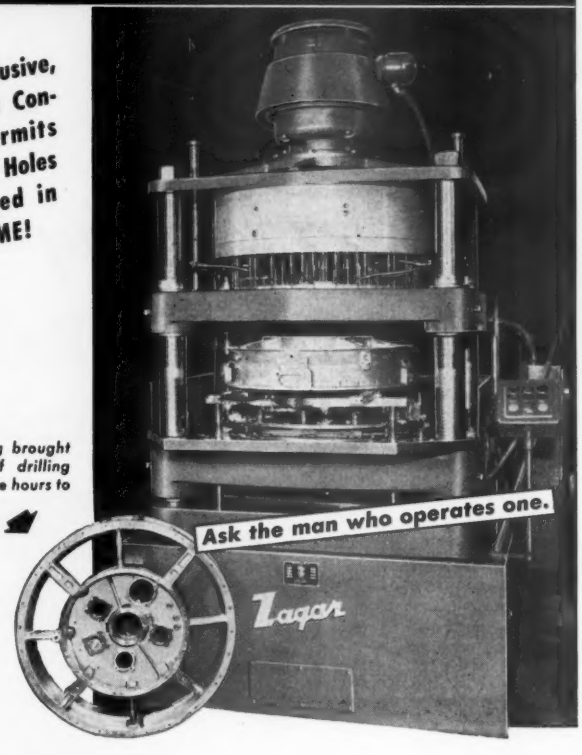
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

CIRCLE INFORM-A-GRAM KEY No. 63

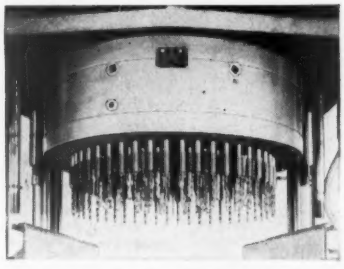
Packard, Too, Uses Zagar ENGINEERED DRILLING IN STANDARD ZAGAR DRILLING MACHINES

Zagar's Exclusive, Rigid 4-Post Construction Permits Hundreds of Holes to Be Drilled in RECORD TIME!



Zagar engineering brought down the time of drilling this part from three hours to seven minutes.

This jet engine part suggests the almost unlimited possibilities in drilling hundreds of holes at one pass. Zagar 4-post machines are built around interchangeable gearless drillheads. Any number of holes on all centers can be drilled as close as twice drill diameter in any material. Zagar's 4-post machines achieve heavy duty, multiple-spindle, close center drilling. . . with greater horsepower and thrust, with better alignment and accuracy, with less breakage of *small drills*. . . Let our engineers calculate your savings by demonstrating the Zagar method.



Zagar Interchangeable Drillhead.

★ ★ ★

Write for Catalog T-3 Letterhead requests, please.

ZAGAR TOOL, INC. 24000 LAKELAND BLVD. CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY — ZAGAR TOOL, INC. 24000 LAKELAND BLVD. CLEVELAND 23, OHIO

CIRCLE INFORM-A-GRAM KEY No. 64

"Hydroform" Demonstrated at PMI Meeting

The Hydroform process developed by the Cincinnati Milling Machine Company, was the principal feature that brought more than sixty members and guests of the Pressed Metal In-

Arthur Woodbury of Roland Teiner Company, Inc., showing John E. King, Chairman of New England District, Pressed Metal Institute — typical parts made by Hydroform.

stitute together for their first Fall (1953) meeting. A part of the program included a visit and Hydroform demonstration at the Roland Teiner Company, of Everett, Mass.

Members watched the Hydroform make a single draw operation, pressing blanks into shapes usually requiring several draws by stamping, and also witnessed changes in tooling from one part to another. In one case, tools were changed in less than seven minutes, and immediately the Hydroform was producing a different part from a different metal.

The Hydroform is a cavity type, hydraulically operated ram and head machine, designed, so that pressures up to 15,000 psi can be controlled to press metal around the punch. No metal die is required with this process.

At the demonstration meeting, representatives of the Cincinnati Milling Machine Company talked briefly about this latest contribution to the pressed metal industry, and the types of work where this process provides the industry with economic advantages.

Chief among these were the cost advantages of less expensive tooling! producing more complex shapes, with fewer operations; and being able to produce parts in small quantities for research and experimental work.

mens machine-welded using helium as the shielding gas have indicated a better ductility. Argon seems to be better for manual welding. A combination of helium and oxygen may provide a weld of higher ductility, in the case of machine welding.

All specimens were welded on grooved copper backing bars, with gas introduced to blanket the underside of the weld. An ideal groove seems to be ¼" wide and 0.010" deep; with such a shallow groove, it does not appear necessary to use gas on the underside of the weld.

Fig. 2. Manually welded Titanium tank.

Typical automatic weld data: No filler wire, 50 amps d-c, 13 volt arc, 1/16" thoriated tungsten electrode, helium shielding of 25 cu ft/hr at torch and 10 cu ft/hr backup, carriage speed of 19 ft/min. These specs provided ultimate strength averaging better than 77,000 psi, and average elongation of 18.0%. In 180° free-bend tests, a ratio of bend diameter to sheet thickness ranging from 1½ to 2 was experinced. Other welding specs varied, with results shown in Figure 1.

When titanium welds were rewelded over the entire length of the weld to simulate repair welding, the weld ductility was approximately that of the original weld. However, examination of the tensile specimens showed numerous small cracks in the heat-affected zone adjacent to the weld, as shown in Figure 3. The brittleness of this zone was confirmed by subsequent bending tests, in which the specimens failed almost immediately on starting the bend. This was very noticeable on specimens that had been subjected to three or more passes, indicating that repair welding must be kept to a minimum.

A small spherical tank (about 5" O.D.) was fabricated for test purposes, and welded manually as shown in Figure 2. Argon was used for shielding. Distortion was negligible. The tank was hydrostatically tested, and a crack occurred at 2700 psi, equivalent to a tensile strength of 90,000 psi. The crack was repaired and the tank retested with the same results.

Fig. 3. Tensile specimen, showing cracks in heat-affected zone.

ing also occurs above this temperature. If higher temperatures are used, it should be in the initial stages so that later operations may break up or modify this coarser grain structure.

Commercially pure titanium may be forged with the same dies as those used for steel. Heavier die blocks and wall sections are recommended, though, for titanium alloys, because of the higher resistance to movement of these materials. Sufficient hot working is a necessity in producing titanium forgings. For this reason, it is recommended that cast ingot metal be reduced 70 to 80% in cross-section by the time the forging is finished.

All general types of heating furnaces have proven satisfactory in forging work. For relatively thick sections, no special atmosphere is required. Care should be exercised, though, in using furnaces in which steel forgings have been heated. The floor of the furnace should be thoroughly cleaned, or the titanium stock should be protected from contact with the hearth. If these precautions are not followed, a surface reaction will occur between the hot titanium and contaminates left by the steel. Titanium forgings may be cleaned by grinding, sand-blasting, shot-blasting, or tumblasting, which is followed by pickling in a 10% solution of nitric and hydrofluoric acid. Swaging titanium at room temperatures is not satisfactory because of cracking, but this tendency disappears at temperatures of 400° to 500°F.

Scrap Recovery

Because of the troublesome melting characteristics of this metal, the recovery of scrap requires a much more elaborate process than for other commercial metals. While titanium producers report a good percentage of scrap recovery, the necessary facilities may not be readily available to average manufacturers. For this reason, designs should be made with some thought to a minimum of scrap production.

Note: The information contained in this Section, Handling and Fabrication, is intended only as a general survey of the characteristics to be encountered when present manufacturing processes are applied to titanium and its alloys. Specific alloys may require special considerations.

. . . Fabricating, from page 43

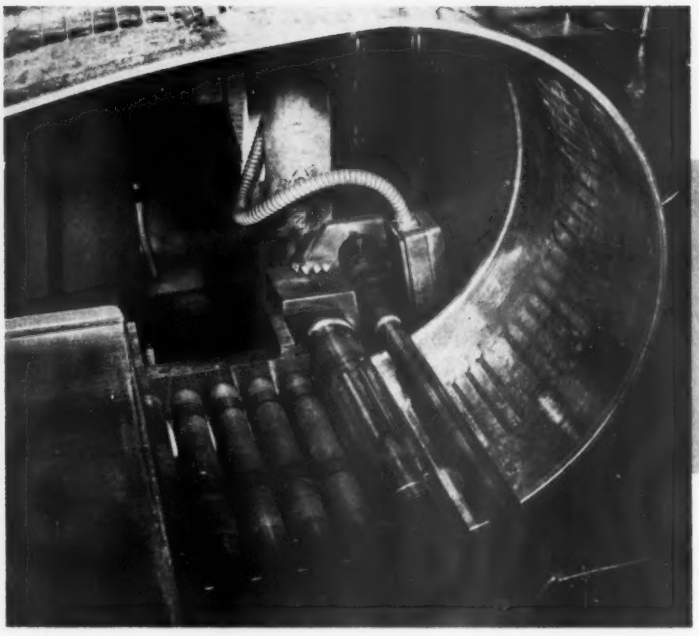


Fig. 6. Bending and corrugating operations are performed successfully with zinc coated material.

machine or a spray washer having an emulsion type cleaner can be employed effectively. In the later case, the cleaner should be removed by a hot water rinse after which the sheets are thoroughly dried. Due to the reactivity of the zinc coating to alkalies, and acids, alkaline cleaners and acid dips should be avoided.

The availability of a zinc coated sheet or strip, which has the already mentioned brittle iron-zinc layer removed, has increased the usage of this class of material. This material is supplied with the standard weights of coating and, when required to have extreme flatness, the sheets may be specified as stretcher-leveled. In the event that these coated sheets or strip be used on a specific job, it is suggested that on the initial order, a blueprint of the job be included so that the material ordered will perform the job intended with satisfaction. Another method of specifing this material is the use of the following in an appropriate specification, ([3]) namely:

"HOT DIP PROCESS — Special adherence — A uniform zinc coating shall be applied by the hot-dip process to both sides of the base metal in such a manner as to provide a coating that is tightly adherent to the base metal, which will conform to tests outlined in the table shown here without flaking or peeling on the outside of the bent portion. These bend tests shall be conducted in accordance with provisions of A.S.T.M. Specifications A93-48T".

This material can be adequately formed in a variety of shapes by such procedures as press forming, brake forming, roll forming, spinning, etc. In press forming operations, the advantages in the use of coiled stock are that handling costs are reduced and, when applicable in multi-station equipment, the speed of operational procedure from blank to completed item is increased. This latter phase is aptly illustrated in Figure 1 which shows pressure seal caps for automobile fuel tanks progressively formed

. . . *Continued on page 68*

Table 1

Nominal Weight of Coating	Number of pieces of same gage over which sheet is bent to determine coating adherence	
	Zinc-Coated Sheet Gage	
(oz/sq. ft.)	16 to 20 gage incl.	22 to 28 gage incl.
2.00	2	4
1.75	1	2
1.50	0	0
1.25	0	0

0—will bend flat on itself

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. . . Fabricating, from page 66

from coil material. In the event of a deep drawing operation, individual blanks are drawn in a procedure very similar to that employed for the uncoated base metal in that equivalent press power and both similar die material and die design is employed. For best results in drawing, the presses employed, as indicated in Figure 2 illustrating the drawing of a shallow pan, should be of the slow double-action type. Although, in many instances, the average die clearances used in drawing the uncoated base metal is also applicable in drawing of the coated sheet, due to the extra thickness provided by the coating it may be necessary to have the clearances slightly on the heavy side.

As is indicated in Figure 3, which illustrates the sequence of draw operations in the production of a container for liquids, the zinc coating actually stretches to conform to the shape of the draw piece. In this specific example, the cupping operation and the succeeding two re-draws are performed by the conventional method in that the punch is activated in forcing the workpiece to the conforming limits of the draw die. In the third re-draw, the shape is obtained by the use of a reversed drawing technique. The blank employed is 26⅛ inches in diameter; the dimensional values of each succeeding draw-piece being: (a) the cupping operation which produces a shell 5¾ inches deep by 17¾ inches in diameter; (b) the first re-draw produces a shell that is 7¼ inches deep by 15½ inches in diameter; (c) the second re-draw produces a shell that is 9 inches deep by 13¾ inches in diameter; and, (d) the third re-draw with final dimensions of the completed shell becoming 10½ inches deep by 11¼ inches in diameter.

Another example of the drawing capabilities of this material is illustrated in Figure 4 which shows a part of a fertilizer can; a 24 inch blank being employed with the completed shape being produced in two draws. The dimensions of the complete shell as illustrated are 9 9/16 inches deep and 13¾ inches in diameter at the widest section. Subsequent operations include stamping out of top and bead forming.

This material is also used extensively in home laundry equipment due to the added corrosion resistance given by the coating. In many instances, as is the case with washing machine covers, additional protection is given the product by the use of a painted finish.

As with any other type of material, each specific job should be evaluated individually to determine whether the reductions involved in press working are compatible to the mechanical properties and characteristics of the base metal. It should be remembered that the value of the zinc coating is destroyed when intermediate annealing is required to complete the draw-piece. In the event of gage reduction for any specific application, it is well to re-evaluate the drawability of the material since there is a definite relationship between drawability and the gage of material. Thus, a simple draw with a material thickness of 0.050 inches may be quite severe when 0.031 inch stock is used as a substitute.

The choice of lubricant is usually determined by such factors as the type of operation, the severity of forming, the design of the part to be formed, and the type of equipment available. It is well to seek the advice of a lubricant engineer and, in many cases, experimentation is in order to get the process under strict control. In a specific instance where washing machine covers had been press drawn, a water soluble lubricant, at a dilution of 6 parts of water to 1 part of base, worked exceptionally well. However, serious loss of parts was experienced due to the slippage occurring during actual forming. In this instance, the draw ring was provided with a groove so that during the drawing operation, the required hold-down was accomplished by pinching a flange in the groove.

Where the drawing operation is severe, an oil base lubricant may be required. Regardless of the type lubricant employed, the method chosen for application must assure a uniform and thin film of lubricant over the entire area of the draw-piece. This may be accomplished by the use of rolls or by spraying. Usually, removal of lubricant is not required unless it is of a corrosive nature, i.e., a lubricant which may contain sulfur compounds or alkaline soaps. Emulsion cleaning or degreasing can be then employed.

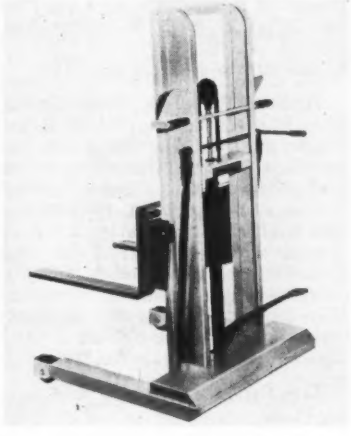
Both brake forming and roll forming can be used in forming this type of material. In the latter method, channels, moldings and similar shapes are formed from zinc coated stock under conditions similar to those used for the low carbon steels. With a material such as Zincgrip, the only limitations in roll forming is that the finish be preserved by the use of highly polished tools. A lubricant such as kerosene or light oil is satisfactory for this operation. Both power and hand brakes can be employed in brake forming; this operation often being performed without the benefit of a lubricant provided highly polished dies are employed.

. . . Continued on page 74

NEW FEATURES ADDED TO BIG JOE LIFT TRUCKS

Foot-Operated Lift Trucks

A new "Triple-Action" hydraulic pump—the first successful pump of its kind in the materials handling field—will more than triple the lifting speed of all foot operated "Big Joe" Hydraulic Lift trucks on loads up to 250 lbs., it has been announced by the manufacturer. The new pump now becomes standard on all Big Joe foot operated hydraulic models.



Battery-Operated Lift Trucks

A maximum lifting speed of 40 feet per minute is one of several major developments included in the newest line of Big Joe battery-operated hydraulic lift trucks. Identified as "The Timesaver" line, these new units produced by the Big Joe Manufacturing Company, Chicago, were introduced for the first time at the Fifth Plant Maintenance Show last January at the International Amphitheatre in Chicago. This model features a remote push button control which allows the operator to ride on the forks or platform to the top of the lift and yet operate its raising and lowering mechanism at the same time.

For further information write Big Joe Manufacturing Company, 904-06 W. Jackson Blvd., Chicago 7, Ill., or

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"Meehanite Castings for Pressure Tightness" is a 48-page bulletin containing 64 illustrations of specific industrial applications of Meehanite castings where specifications demand absolute density, uniformity and resistance to various pressure ranges. It also provides some engineering property charts and pressure casting design suggestions. For your copy write to The Meehanite Metal Corp., 714 N. Ave., New Rochelle, N. Y., and ask for Bulletin No. 43, or——
Circle Inform-A-Gram No. C1.

Machining Magnesium. The production of magnesium has increased many fold in recent years and magnesium alloys now occupy an important position among the structural metals in use. Here is a booklet which gives a vivid picture of the metal from its basic history to its present place in the metalworking field. It is available from The Dow Chemical Co., Magnesium Div., Midland, Michigan. **No. C2.**

A Unique Method of photo-mechanically producing master negatives for use in quantity manufacture of reticles, precision scales and dials is described in a new booklet published by W. & L. E. Gurley, Industrial Division, Troy, N. Y. The booklet also features other methods of making masters for use in photo-duplicating processes. Preparation of master drawings, the use of micro-manipulators for retouching and the role of mechanical dividing engines in making negatives for scales having a repetitious pattern are described. **No. C3.**

Conversion Chart. Weights per 18-inch piece of standard sizes of flat stock are given on this "hang-on-the-wall" conversion chart available from Pittsburgh Tool Steel Wire Co., Monaca, Pa. Heat treating instructions and hardness values also given.
Circle Inform-A-Gram No. C4.

"How to Get Better Welds," a welder's vest pocket guide, covers this important process from explaining metals and electrodes to a study on the 4 essentials for welding procedure. The highly informative manual is available from the Hobart Eros. Co., Hobart Sq., Troy, Ohio.
Circle Inform-A-Gram No. C5.

"Blast Cleaning" offers a fresh approach to explaining abrasive cleaning. Its purpose is to supply non-technical information to anyone who would like to know more about the possibilities of blast cleaning in his field. Copies are available from the Pangborn Corp., Hagerstown, Md.
Circle Inform-A-Gram No. C6.

Electroplated Rhodium. Here is a technical data sheet which contains, among other things, the physical properties, electrical properties, applications and specifications of Electroplated Rhodium. The data sheet is suitable for filing in your technical notebook. It is available from Technic Inc., Providence, R. I.
Circle Inform-A-Gram No. C7.

If You're A Tap User this book should be high on your must list. It is a handbook that gives data on the selection of taps; basic thread dimensions and tap drill sizes; tap usages; cutting speeds; screw thread terms and definitions; and how to sharpen taps. Illustrations also included. The handbook is available from the Besly-Welles Corp., 118 Dearborn Ave., Beloit, Wis.
Circle Inform-A-Gram No. C8.

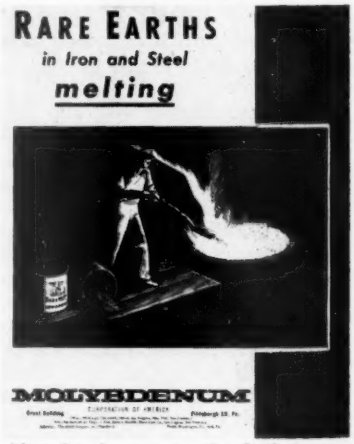
Torque Manual. TOOLING and PRODUCTION readers are sure to find this booklet of unlimited value. It elaborates on the general principles of torque tools and their use. It is especially helpful to persons responsible for torque control specifications and applications. The manual was compiled at the Laboratory Division of the P.A. Sturtevant Co., Addison, Ill.
Circle Inform-A-Gram No. C9.

Successful Silver Brazing. This manual has been prepared for engineers and brazing operators. It includes general data on successful silver brazing and is available from the American Platinum Works, 231 N. J. R. R. Ave., Newark 5, N. J.
Circle Inform-A-Gram No. C10.

Vapor Degreasing. Here is a question and answers handbook on engineered metal cleaning equipment for production men, engineers and students. It is available from the Phillips Mfg. Co., 3475 W. Touhy Ave., Chicago 45, Ill.
Circle Inform-A-Gram No. C11.

Turbine Wheel & Ring Chucks. This book is descriptive of special chucks which Cushman Chuck Co., Hartford 2, Conn., has designed and manufactured for gripping turbine wheels and rings without distortion. The book is not a catalog, but is intended as an indication of what Cushman has done and is doing to overcome a difficult holding problem. If you plan to write the company direct, ask for Book No. 852.
Circle Inform-A-Gram No. C12.

Rare Earths in iron and steel melting is the topic of Process Report No. 1 compiled by the Molybdenum Corporation of America, Grant Building, Pittsburgh 19, Pa. This booklet lists 15 elements which are considered to be rare earths. It then goes on to describe these elements; relate where they are found and their useful applications. This booklet on rare earths is a rare gem in any technical library.
Circle Inform-A-Gram No. C13.



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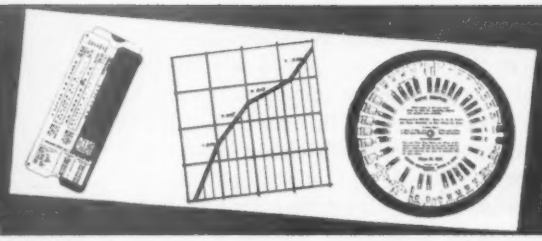


Precision Barrel Finishing. Lord Chemical Corp., York, Pa., has issued a 32-page handbook and catalog on compounds for descaling, deburring, abrasive cut-down, non-abrasive cut-down, finishing, burnishing, metal cleaning and rust inhibiting. A "rapid application index" gives the reader a quick reference to the particular standard and special purpose compounds recommended for various applications.
Circle Inform-A-Gram No. C14.

Cylindrical Grinding Handbook. This booklet provides information about important factors that determine the performance of center-type cylindrical grinders of all makes. It contains charts of grinding wheel speeds and gradings in one section while another part features hints on how to correct practically all grinding troubles. Many important suggestions about operation, maintenance and safety are also included in the handbook. It is available from the Landis Tool Co., Waynesboro, Pa.
Circle Inform-A-Gram No. C15.

For Industrial Training. Officials charged with apprentice training in industry will appreciate a color folder describing all of South Bend Lathe's instructor-student aids. Bulletin 5329 covers the company's standard books on lathe, drill press and shaper operations and charts and shop course instruction as well. Training movie films and scale models of the machine tool line for shop planning and illustrating lectures also are included. Write to South Bend Lathe Co., South Bend 22, Ind.
Circle Inform-A-Gram No. C16.

Uses of Aluminum-Magnesium-Fiberglas in modern design is explored in a new 16-page booklet on the lightweight structural materials. The booklet traces the history of light metals technology—surveys the use of aluminum and magnesium in present day design and gives an objective appraisal of their possible range of application for the future. One section is devoted to fiberglas laminations, the most recent of the lighter materials. It tells how they are molded and gives important factors on their design. The highly informative booklet is available from the Rolle Mfg. Co., Cannon Ave., Lansdale, Pa.
Circle Inform-A-Gram No. C17.

For the Machinists Toolchest or pocket size reference, a decimal equivalent card listing fractional parts of an inch to six places is being offered by the South Bend Lathe Co., South Bend 22, Ind.
Circle Inform-A-Gram No. C18.

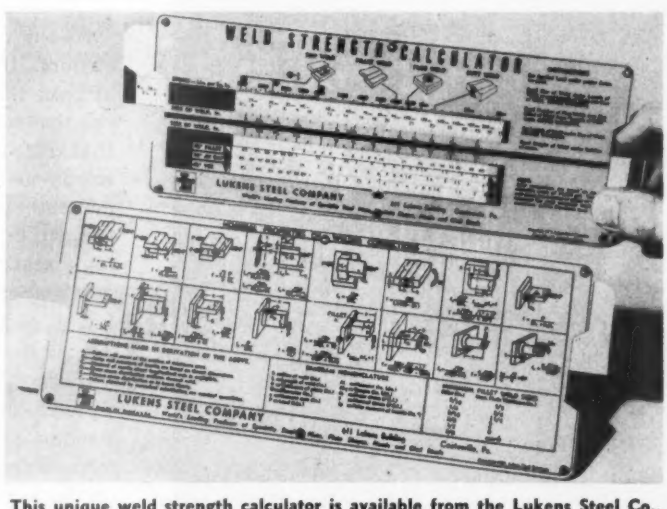
"Profits Through Effective Machine Replacement Programs." This is a paper (Publication No. M-1828) written by two executives of the Cincinnati Milling Machine Co., Cincinnati 9, Ohio. It suggests a more effective means of helping management determine when machines should be replaced and how much it will cost "not" to replace worn-out or obsolete equipment.
Circle Inform-A-Gram No. C19.

"Magnetism In Stainless Steel Castings" is a data sheet recently issued by Empire Steel Castings, Inc., Reading, Pa. It clarifies the relative importance of magnetism in chromium and in chrome nickel stainless castings and wrought types. Questions discussed in the bulletin are: "Do magnetic tests measure corrosion resistance?", "Can magnetism vary in castings of somewhat similar compositions?", "What gives the foundryman good castability?", and "When are magnetic tests useful?".
Circle Inform-A-Gram No. C20.

Facts About Low Hydrogen Electrodes" is the subject of this booklet written by two executives of the Alloy Rods Co., York, Pa.
Circle Inform-A-Gram No. C21.

Money-Saving Tips. Questions like these about die maintenance: How often should I clean? Where's the best place to store? What lubricant should I use? What's a quick test for proper mechanical contact?—are just a few of the profitable tips contained in "How to Save Money on Punches and Dies," a handy little booklet prepared by the F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia 20, Pa. **No. C22.**

Machining and Grinding the Age-Hardenable Nickel-Chromium-Iron Alloys, Inconel "X", Nimonic 80A and Nimonic 90 are described in a booklet prepared by the Development and Research Division of International Nickel Co., Inc., 67 Wall St., New York 5, N. Y. This booklet should be of interest to TOOLING and PRODUCTION readers because these alloys are used for high-temperature, corrosive conditions under stress and are important engineering materials for aircraft parts which must possess high strength and resistance to creep and to oxidation at elevated temperatures.
Circle Inform-A-Gram No. C23.



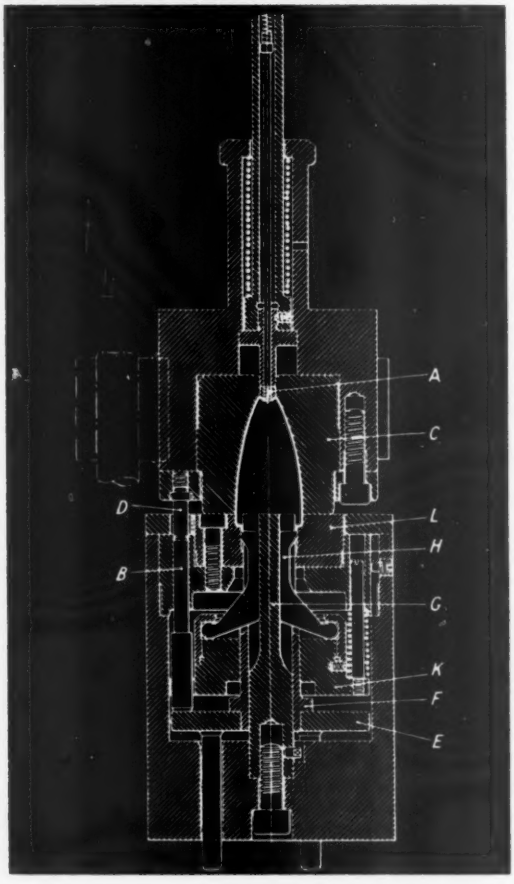
This unique weld strength calculator is available from the Lukens Steel Co., Coatesville, Pa. for the convenience of designers, engineers and others interested in steel plate fabrication. Circle Inform-A-Gram No. C24.

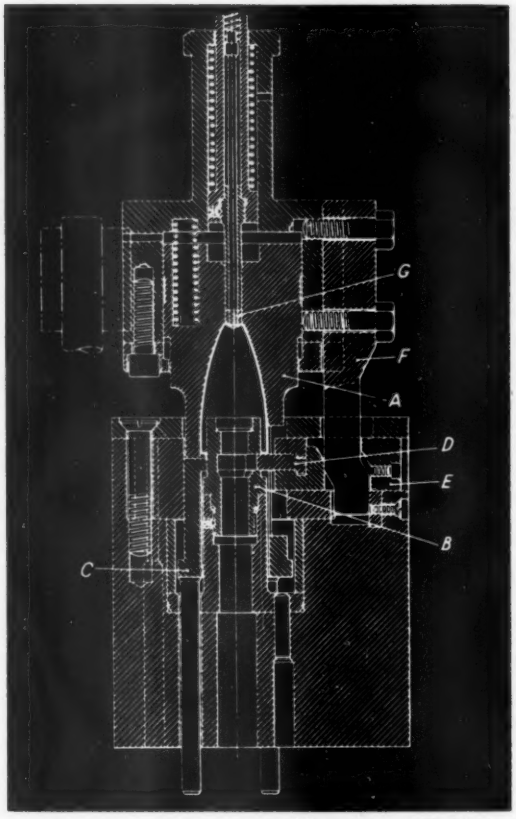
. . . Press Production, from page 57

Four equi-spaced sliding members are incorporated in the pressure plate of the lower tool, and advance, under spring pressure, into the annular space between this plate and the forming punch, as the plate ascends after the drawing operation. An adequate seating is thus formed for the small bearing area of the workpiece until it is gripped by the transfer fingers.

The three tools at stations 10, 11 and 12 are of similar construction, a sectional view of the third tool being shown in Figure 8. The die L and the punch G, however, are progressively smaller at each stage, so that the seating is gradually formed. In operation, the component is supported by the plunger A until it is located in the workholder C. As the ram approaches the end of its stroke, the pins D and B force the plate E downwards against the pressure of an air-cushion, so that the sleeve F slides down the stationary punch G. Six fingers H, sliding in grooves in the punch, move downwards with the sleeve F, under the action of the spring-loaded block K. The fingers pivot

Fig. 8. Three tools, similar to the above, form the seating element of the lamp body.





Photos courtesy E. W. Bliss Co.

Fig. 9. At station 13 cam-operated punches cut the body seating notches.

inwards during their downward movement, so that their upper ends can pass into the forming diameter of the die L. During the latter part of the downward movement, the workholder C forces the component into the die, the internal diameter of the seating being controlled by means of the slotted head of the punch G.

As the ram ascends, the pressure of the air-cushion lifts the sleeve F, raising the fingers H and the block K. The position of the sleeve F relative to the fulcrums of the fingers ensures that their upper ends expand as they move upwards to eject the workpiece. This outward movement of the fingers causes them to span the gap between the punch and the die, forming a seating for the component, flush with the top face of the tool.

The notches in the seating of the lamp body are produced at station 13 by the tool shown in Figure 9. A spring-loaded work-holder, A, thrusts the component downwards over the circular spigot B incorporating the notching dies. The pressure of an air-cushion is exerted on the sleeve C, which is forced downwards by the component until the shoulder thereon

. . . Continued on page 157

Improve Inspection Methods with Existing Equipment

A new solution to an old problem makes possible a means for economically achieving high rates of inspection by utilizing, not obsoleting, existing magnaflux units.

The answer is simpler than expected. It is a new conveyorized auxiliary production unit which works from small to medium sized parts in conjunction with any standard stationary Magnaflux unit to provide high volume inspection at low cost. Because

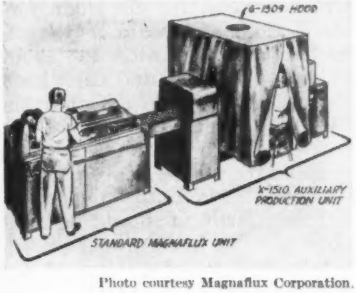


Photo courtesy Magnaflux Corporation.

these new units work in conjunction with any standard unit, this development will be of great benefit to old and new users, alike, in meeting their inspection problems.

The key is conveyorization. By adding one of the auxiliary production units to a standard Magnaflux unit, the old ratio of one operator to each inspector is greatly improved. With the addition of the new unit, one operator can supply either two or four inspectors, and the production rate of the standard unit is more than doubled, in some cases quadrupled. The conveyorized auxiliary unit does more than increase the speed and efficiency of inspection. It smooths out the work flow, and in process control it reduces waste processing time.

The operation of the new units is extremely simple. The operator of the standard Magnaflux unit magnetizes the part and places it on the conveyor. The auxiliary production unit does the rest. It carries the part through a bath application station to the inspectors who remove unacceptable parts. Acceptable parts are then carried through the demagnetizing process through the inspection cycle.

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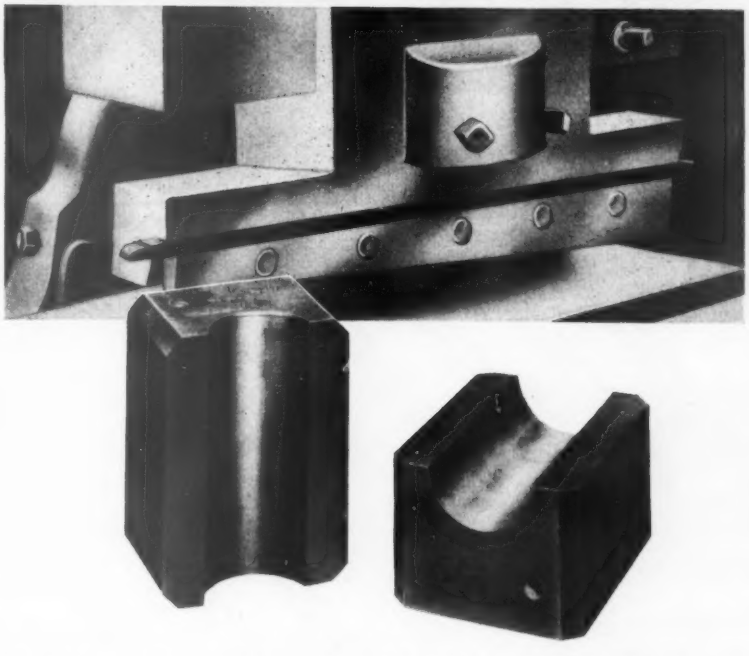

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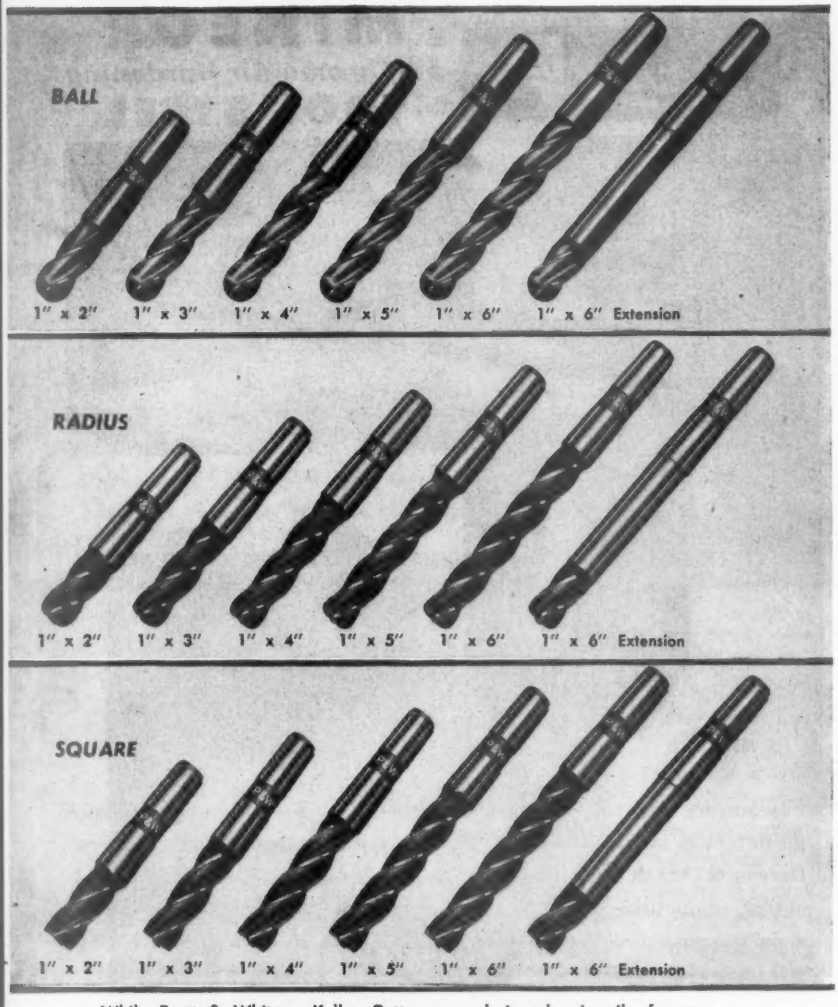

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. . . Fabricating, from page 68

ent metal. The jaws should be as close to the weld edge as possible and sufficiently tight to prevent excessive expansion and contraction. Since volatilization of zinc occurs, it is advisable to have some means for removing the objectionable fumes from the vicinity of the work.

In a metallic arc procedure for welding, either A.W.S. type E6010 and E6011 electrodes can be used; the procedures employed being quite similar to that used for the uncoated material with the following exceptions. Thus, it has been recommended [1,7] that the weld be placed in position a little more slowly; a whipping motion being employed which moves the electrode forward along the seam in the direction of progression for about 1/8 to 5/16 inches and then back to the molten pool. This practice will tend to volatilize the zinc coating from the area to be covered by the weld bead before the bead is actually deposited. All volatilization should be complete prior to bead progression.

In a carbon arc welding procedure, a copper-silicon-manganese filler rod is usually employed due to the lower temperature realized during a welding process. For 16 and 18 gage material, a 3/32 inch diameter filler rod is recommended [1,7] which is used in conjunction with a 5/32 inch diameter carbon electrode. In welding either 20 or 22 gage material, the filler metal diameter is increased to 1/16 inch while the carbon electrode diameter remains at a value of 5/32 inch. The carbon electrode should have a long, thin taper; the electrode holder gripping the carbon about 1½ inches from the point so as to retain this taper during the welding operation.

The current, which is usually D.C. with straight polarity, will vary from 50 amperes for 16 gage material to about 20 amperes for the lighter gages; the value depending upon the type of joint that is being welded. In laying the bronze filler metal within the confines of the joint, an angle varying from 10 to 20 degrees from the horizontal is employed; the arc being as short as possible and directed on the filler metal rather than on the sheet being welded. This practice will result in a smooth weld deposit

with a minimum loss of the zinc coating in the area of the weld.

An improvement of the standard electrode, the copper-silicon-manganese as given above, is the copper alloy, tin coated filler rod ([1]). This is a patented procedure which has worked quite well in carbon arc welding of zinc coated materials. With proper procedure, this method covers the heat zone of the weld ([1]) with molten tin while the copper alloy rod is being deposited. The resultant coating of both zinc and tin alloy along the weld provides added corrosion resistance.

In oxy-acetylene welding, the use of a bronze welding rod of a similar composition to that employed in carbon arc welding is preferred since (a) a rapid forward progression can be realized and (b) a minimum loss of coating in the weld area will be realized. In this method of welding, protection of weld is realized by the use of a heavy coating of brazing flux in thick paste form which is applied to each side of the plate and/or on the bronze filler rod. Best results are obtained ([3]) when the filler rod is moved back and forth producing a "ripple" weld. A neutral flame is used and, as in carbon arc welding, the heat should be concentrated on the welding rod rather than on the sheet being welded.

In regard to types of joints employed in fusion welding, joint design is very similar to that employed in mild steel welding. A recommended joint ([1]) is obtained by running one of the sheets through a roll or press brake to obtain an offset lap joint. In this type of joint design, the weld metal will flow readily and has the further advantage in sheet metal welding of serving as a "stiffener" in that it reduces, to a very noticeable extent, the effect of warping. If this type of joint is too expensive, the straight lap joint is frequently employed; tack welding every few inches along the joint seam often being used to maintain alignment. Other standard joints employed would include the edge or fillet weld, the butt joint with the sheared edges either abutting or slightly turned up.

In a resistance welding procedure, due to the influence of the zinc coating, both the current

. . . *Continued on page 104*

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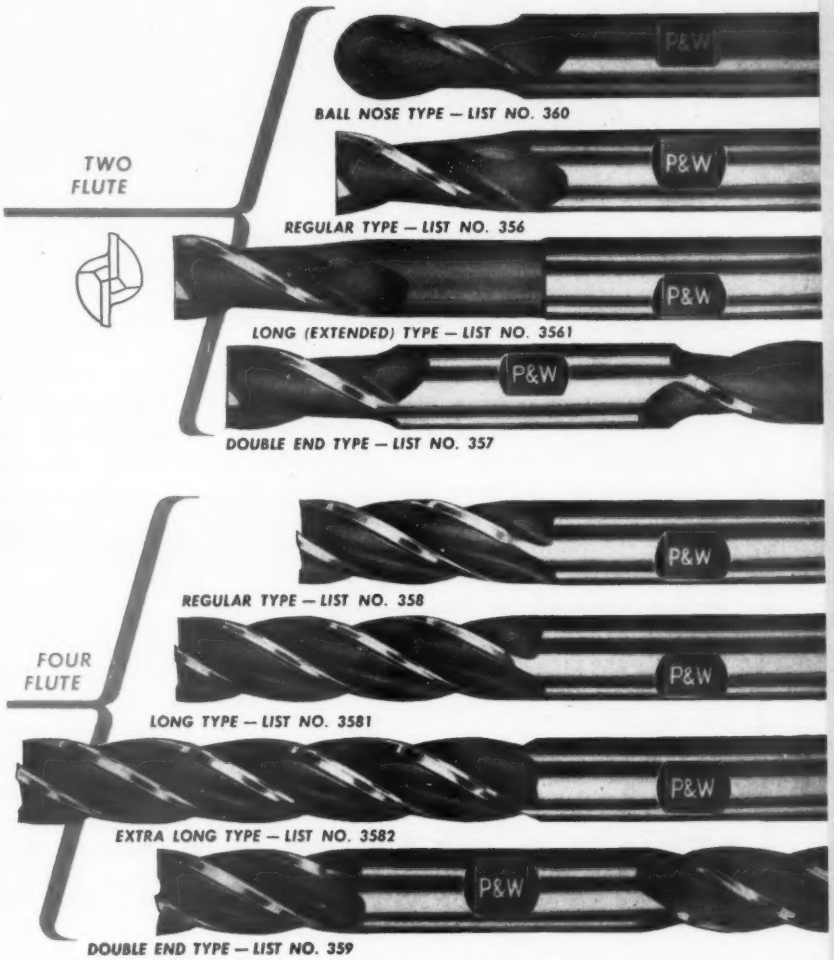
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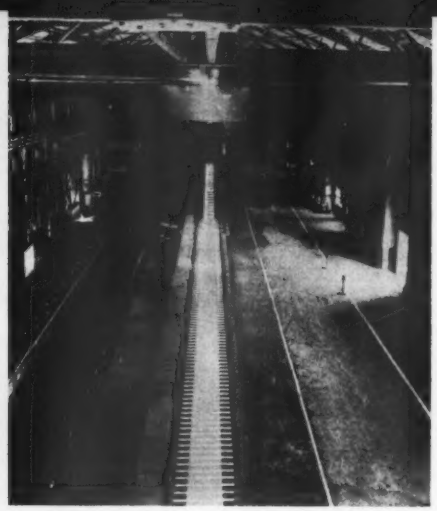


The operator of this 80-inch hot strip mill of United States Steel Corporation's Gary Sheet and Tin Mill occupies a control pulpit 395 feet from the coilers. The RCA I T-V and 10-inch receiver give him a "play by play" view of the strip as it travels from the finishing stand to the coiler and enables him to spot potential pile-ups and cobbles before the strip is coiled.

. . . T-V in Industry, from page 44

nuclear research, observing conditions inside furnaces, as well as for coordinating materials flow on conveyors.

Other leading producers of industrial television equipment are the RCA Victor Division of the Radio Corporation of America, the Allen B. DuMont Laboratories, Inc., and Remington Rand.

The development of I T-V has resulted in equipment considerably different from that used in commercial or entertainment T-V. Although the basic operating principles of the two systems are the same, initial attempts to employ broadcast equipment in industrial setups were neither practical nor economical. Whereas the broadcast camera is bulky, weighing up to 100 pounds, and contains many tubes, the smaller industrial T-V cameras, with as few as three tubes, approximate 16 mm movie cameras in size and weight and are just as simple to operate. Thus, they are easily "plugged in" at different locations or viewpoints as desired.

Industrial T-V receivers are no bulkier than entertainment T-V table models.

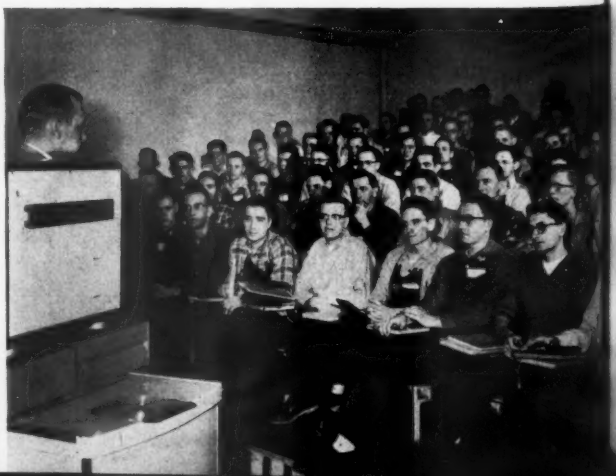
The closed circuit operation of the I T-V camera and receiver means freedom from atmospheric and man-made interference, and the elimination of "ghosts" and "snow". Still more important, industrial television is under none of the frequency bandwidth restrictions and other technical limitations imposed on broadcast television, and requires no license from the Federal Communications Commission to install and operate.

The closed circuit cable of industrial television can carry a far wider communication channel or frequency range of transmission than is allowed for broadcast T-V. This has enabled the DuMont concern to develop a line of high-definition color equipment in addition to black and white. There are many inspection and comparison applications where color is a governing specification.

In the hazardous field of rocket research, color television brings the eyes of distant observers to otherwise hidden or dangerous experiments, and trials. The DuMont color television system is used at the Nation Advisory

. . . *Continued on page 78*

In their lecture room Purdue University engineering students view the "Optics For Industry" exhibits and demonstrations staged in Eastman Kodak Company's traveling display truck. This industry-education tie-up via closed circuit T-V was a notable success.



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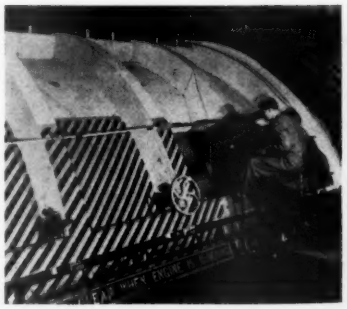
. . . T-V, from page 76

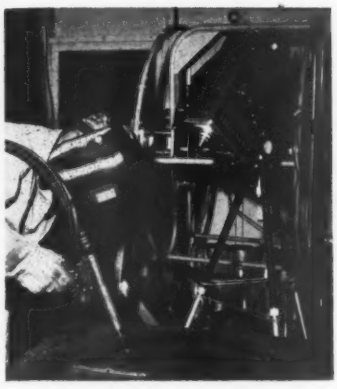
Committee for Aircraft, Lewis Laboratory, in Cleveland, for viewing the latest ramjet aircraft engine in action. Different colors and shades of exhaust gases, which have so much meaning, can be studied in quiet and safety by remote viewing. Likewise, in large scale heat treating operations, and in steel production, where color and temperature are so inter-related, industrial color television performs as an economical, time and labor-saving, aid to process control.

A closed circuit I T-V installation in Chrysler Corporation's Nine-Mile Press Plant in Detroit. The Logemann baler operator controls the baling of scrap steel, puts the bales on a conveyor and loads them into gondolas outside the plant, without moving from his control station. The baler controls and television screen are in the basement gallery and the camera is mounted outside the building about 150 ft. away from the baler.

We have all seen examples, in entertainment T-V, of the split screen; whereby actions that take place in different locations appear simultaneously on the one viewing screen. This ability of a television circuit to look in different directions at the same time has untold possibilities in industry.

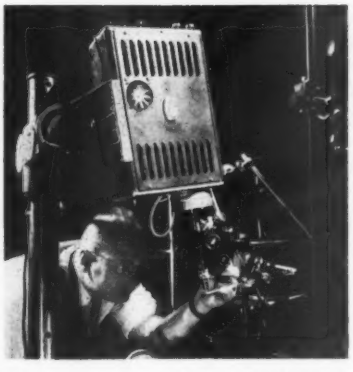


At the Lewis Flight Laboratory in Cleveland, this DuMont Color T-V camera enables observers to make a close-up study of the white-hot engine exhaust gases without danger.



Upon the occasion of a welding manufacturers' convention, the Air Reduction Company demonstrated latest methods for welding metal plates while a DuMont "Tel-Eye" camera picked up the action and transmitted it to several T-V screens for mass viewing.

Particularly does this apply to the fullest exercise of quality control. In a manufacturing plant engaged in a great and widespread diversity of operations, strategically located T-V cameras could provide centrally-located quality control personnel with a constant view of distant inspection problems.



This setup of a DuMont industrial T-V camera unit projects the field of view of a microscope via cable to a standard T-V receiver. The greatly magnified image on the screen can be watched by many people. DuMont's "Tel-Eye" camera plugs into any 117-volt 60-cycle outlet and is connected by cable to any standard VHF television receiver. The camera is completely self-contained, weighs only 18 pounds, and calls for only normal room lighting. It can feed multiple receivers at distances up to 4000 feet without need for extra amplifiers.

The combination of sight and sound, camera and microphone, permits both observation and discussion of problems as they may arise in diverse locations.

. . . Continued on page 82

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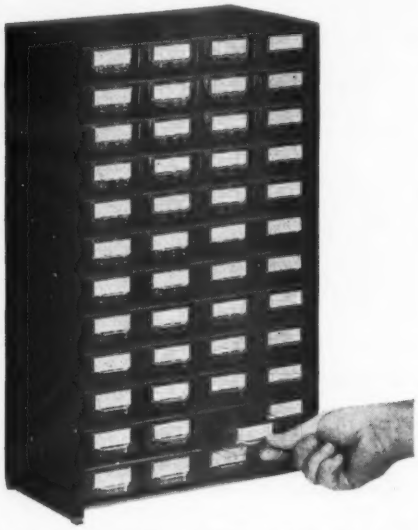

Illustrated — 48-drawer JIFFY Cabinet, red frame with crystal-clear styrene drawers.....only $19.95*

CHECK THESE FEATURES:

• **3 New Color Combinations**
Cocoa Brown with tan drawers.
Black with gray drawers.
Red with crystal-clear drawers.

• **Solid One-piece Back Panels**
Keep dust out . . . maximum strength girder type construction . . . ready-made keyhole slots for handy wall mounting.

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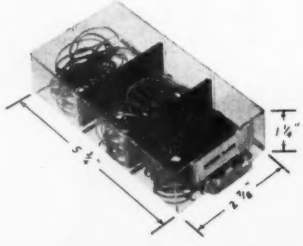
Prevent scratching . . . increase stability . . .. make stacking convenient.



• **Generously Sized Drawers**
More than 18 cubic inches in each one . . . full set of index labels and drawer dividers supplied with every cabinet.

Inside of drawer easily divided into three compartments with metal dividers as illustrated. Each drawer has a stop to prevent accidental spillage and to permit drawer to hang open from back edge. Ribbed runners on bottom of all drawers permit them to slide freely. Index slots on front of drawers allow easy identification of contents.

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☐ **Red w/clear drwrs.** ☐ **Black w/gray drwrs.** ☐ **Brown w/tan drwrs.**
(NOTE: If color is not specified, we will ship Red Cabinet w/clear drwrs.)

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Holding Device Has Automatic Features

The "'John's" drill jigs is an automatic self centering work holding device, with two movable master jaws that work on a right and left hand Acme thread. This allows them to come to the same distance from center every

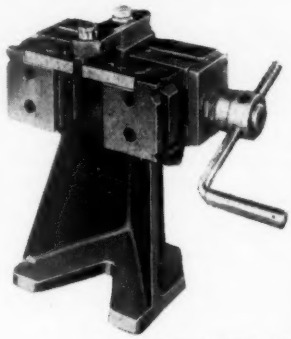

Photo courtesy of Heuser Mfg. Co.

time, regardless of wear of the jig or a variation in piece part dimension.

The jigs are ideal for chucking on rough casting surfaces for drilling the mean center or position off center.

They also can be used as a milling vise where the self centering feature would be an advantage. And they are suitable for drilling and tapping in this position.

Bases are available for mounting the jigs from 1" to 18" off the working surface. Handles are reversible—can be on either side.

Tool & Die Group Names New Official

Charles R. Bender has been appointed assistant secretary of the National Tool & Die Manufacturers Association with headquarters in Cleveland, Ohio, it was announced by George S. Eaton, Executive Secretary. A former tool designer, Bender has been a Chamber of Commerce executive and recently served as Managing Director of the Sidney, Ohio Civic Association. In his new post, he will be chiefly responsible for membership work.

Charles R. Bender

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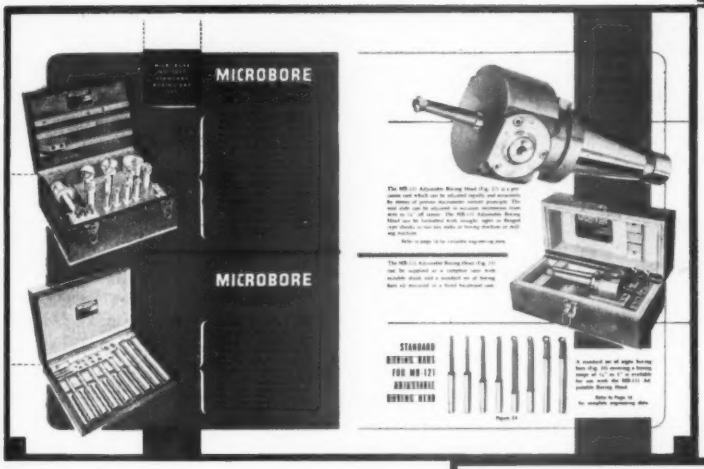

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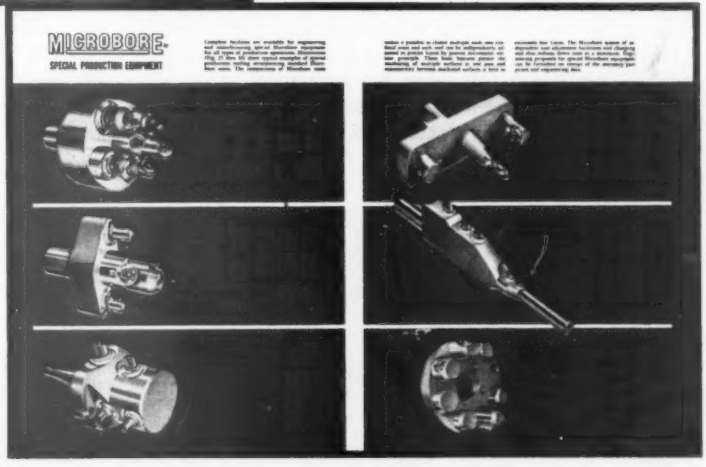

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LENGTH OF PIN 12"
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PREC. OR COMM'L Precision
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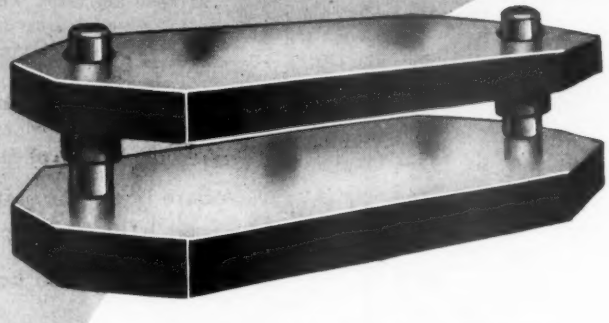

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DAYTON	HE 3042	MONTREAL, CAN.	GL 6126	TOLEDO	MA 4510
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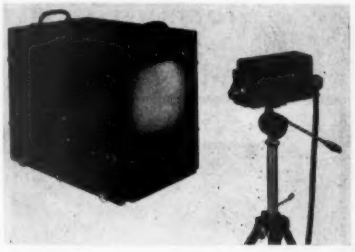
DENVER	SH 2451			WASHINGTON, D.C.	AD 4-5700

CIRCLE INFORM-A-GRAM KEY No. 82

. . . T-V, from page 79

Safeguarding of industrial plants and other buildings is considerably simplified by the television-helped watchman. Located at strategic points about walls, yards, corridors, stock rooms and outside areas, the fixed cameras transmit their views to viewing screens located in a convenient central area.

The instructional and demonstration values of industrial television are obvious. The field of view of a measuring microscope or comparator can be transmitted from a laboratory to a class room just as easily as to the office of a manufacturing vice president or quality control director.



Radio Corporation of America's basic equipment for closed circuit television consists of a camera, control monitor, and connecting cable. The RCA control monitor pictured here contains all operating controls for both the camera and the monitor. It also houses the power supply, voltage regulator, and synchronizing generator.

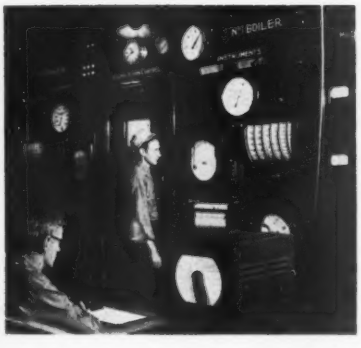
Purdue University, this past January, initiated an experiment in industry-education cooperation which was an outstanding success. The university invited the Eastman Kodak company to bring its exhibit, "Optics for Industry" to the campus to help students learn more about the application of optical methods to gaging and inspection.

Currently touring the country in a 35 ft. truck, the exhibit is similar to many manufacturers' traveling displays. It includes two Kodak Contour Projectors designed for quick, accurate and economical inspection of many mechanical parts, also a number of panels illustrating the theory and application of the equipment.

Normally 12 to 15 people are invited to visit the truck simultaneously. There they are shown a movie and hear a talk illustrated by the display panels. This type of operation is quite satisfactory at industrial plants but, since Purdue's general engineer-

ing classes total 350 students alone—and many members of the school's faculty wished to visit the truck as well—it would have taken many days of "normal" operation to handle all who desired to see the display.

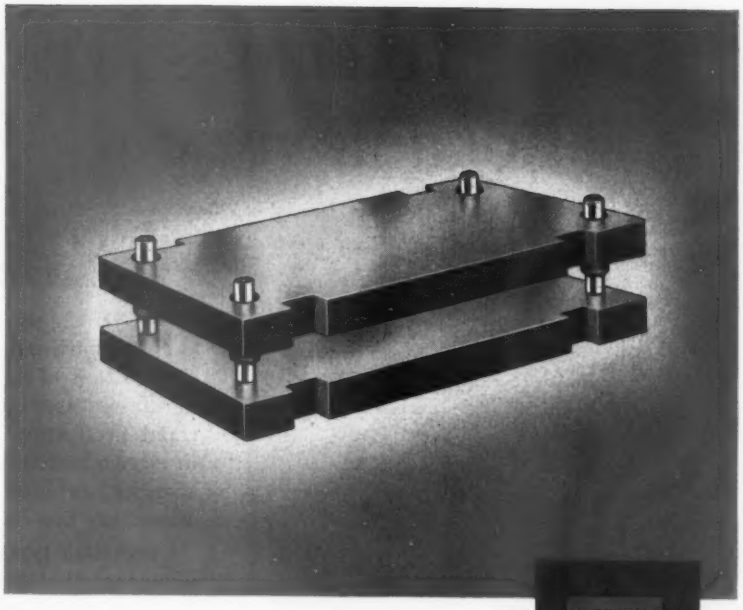
To enable the maximum number to benefit in the shortest period of time, Purdue's Professor O. D. Lascoe borrowed a "Utiliscope" closed circuit TV camera and screen from the Diamond Power Specialty Corporation. Kodak then brought its truck to the school, parked it outside the engineering buildings, and the TV unit was set to transmit images from inside the truck to a nearby classroom.



The picture on this RCA industrial television screen, an outdoor look at the smokestack, gives the power plant operators a constant check on fuel combustion. Other common I T-V power plant applications include water column observation and remote telemetering.

Two shows a day were held. More than 100 students, faculty members, and representatives of nearby businesses and industries watched each show. Robert J. Hudak, of Kodak's Special Products Sales Division, talked in the classroom while the camera—at his direction—picked out various panels in the truck. Following the talk, and question and answer period, students were invited to tour the truck itself. Approximately 2,000 people visited the truck in two days.

In the opinion of Professor H. A. Bolz, Head of Purdue's Department of General Engineering, and others who witnessed the test, the technique has definite possibilities of value both to schools and manufacturers offering similar traveling displays.



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DECATUR, ILL.	8-3474	NASHVILLE	6-2507	TORONTO, CAN.	KE 2972
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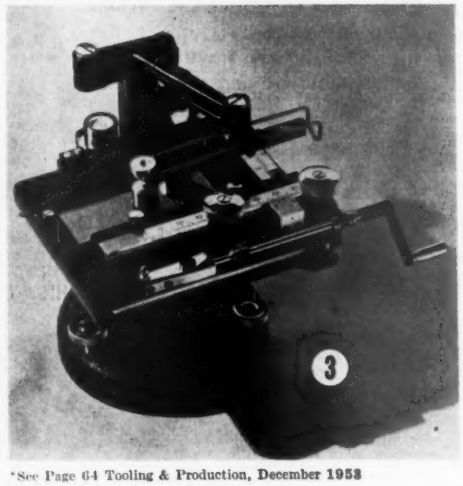
CIRCLE INFORM-A-GRAM KEY No. 83

HARDNESS TESTING EQUIPMENT AND METHODS

Continued *

by John E. Hyler



ONE highly interesting and unusual method of hardness testing on steel parts is the proposition of testing magnetically. A magnetic hardness tester has been designed and produced for rapid production testing of steel parts, produced in large quantities. Advantages claimed for this instrument are high speed, and the fact that tests conducted are non-destructive on finished surfaces.

On certain types of finished surfaces, it is highly important that there be no indentations whatever. To date, the magnetic hardness tester has found its most important application in the ball and roller bearing industries, where hundreds of thousands of bearings and races, ranging in size from a fraction of an inch to six inches, are tested daily at very low cost.

Operation of the magnetic hardness tester is based upon the known fact that both magnetic permeability and electrical resistivity of steel are influenced by the degree of mechanical hardness present. Exact functional relations existing between permeability and hardness on the one hand and resistivity and hardness on the other, depend upon chemical composition of steel. However, for practically any given material, both relations are perfectly defined. Therefore, either relation can be utilized as a secondary method for comparison measurements of hardness.

The answer to the question of whether permeability or resistivity is the best indicator of hardness depends upon composition of the particular materials, and upon the particular hardness range which is of interest in the given plant. The magnetic hardness tester in mind is designed so that a user

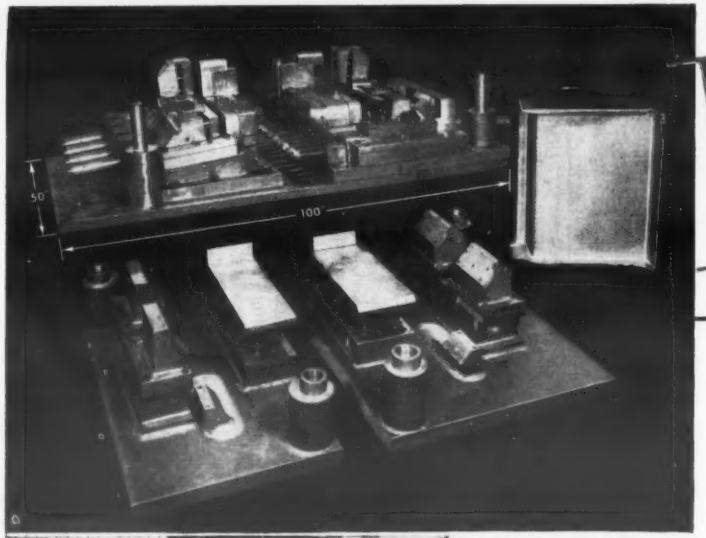
. . . *Continued on page 106*

Fig. 1. This microhardness tester is employed for making individual indentions in crystals within an alloy, and many other hardness determinations. Photo courtesy Eberbach Corporation

Fig. 2. This magnetic hardness tester is widely employed for testing ball and roller bearings and races, where absolutely no indentations may be left on working surfaces.
Photo courtesy Rubicon Company

Fig. 3. This hardness testing instrument is a Microcharacter type. It makes hardness tests by moving a highly polished and lubricated surface of material beneath a very accurately ground diamond point, which is under a definite pressure. The diamond point, in form, is that of the corner of a cube.
Photo courtesy American Optical Company, Instrument Division

*See Page 64 Tooling & Production, December 1953



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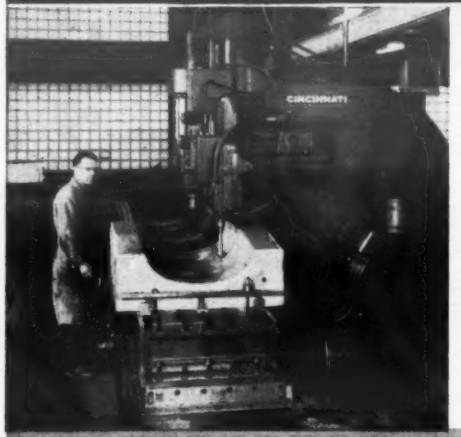

ABOVE: Typical tooling job is the Cam Flange Die shown above. This is an adjustable die to cam flange both sides of three different sizes of range tops with one stroke of the press for each top.

LEFT: Showing work done on a typical job—using a 28" x 96" Cincinnati Vertical Hydro-Tel, with automatic tracer and depth control.

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book review

GEARS
FOR SMALL MECHANISMS

by

W. O. Davis

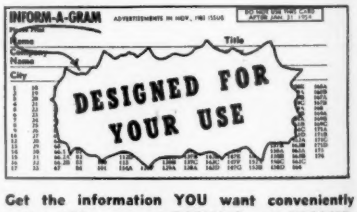
Published by
N. A. G. Press Ltd., London.
Available in the United States from
Huebner Publications, Inc.
1975 Lee Road
Cleveland 18, Ohio

Price: $5.00 postpaid

Here is an outstanding book in its own right, quite apart from the fact that no other book in this increasingly important subject is in existence. Back of it is the authority and reputation of author Wilfred Owen Davis, an engineer who has specialized in small gears and special mechanisms for 20 years.

In his book, a thorough analysis is made for the first time of gears for small mechanisms, and the invaluable advice given to designers, producers and users will be many times more welcome because it is not available elsewhere.

Subjects covered: Theory and Practice of the Design of Very Small Gears — Friction and Efficiency of Tooth Action — Design of Tools for Cutting and Generating Gear Tooth



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Forms — Production and Testing of Gears used in Watches, Clocks, Indicating Instruments, Recording Instruments, Automatic Control Mechanisms and Similar Devices.

When the watch and clock industry was reborn in Britain after World War II, Mr. Davis played an important part in its amazing expansion through his firm S. Smith and Sons, while still carrying on valuable work in the design and manufacture of instruments and other mechanisms.

Until now he has remained one of the "back-room boys" of industry, but the success of a lecture to members of the British Horological Institute in London prompted the publishers to urge him to write this book.

Will You Be There?

March 16-17. Steel Founders' Society. Annual Meeting. Edgewater Beach Hotel, Chicago.

•

March 17-19. Pressed Metal Institute. Annual Spring Technical Meeting. Hotel Carter, Cleveland.

•

March 19-20. Machinery & Allied Products Institute. Conference on Capital Goods Economics. The Greenbrier Hotel, White Sulphur Springs, W. Va.

•

March 29-31. Society of Automotive Engineers, Inc. National Production Meeting and Forum. Hotel Drake, Chicago.

•

April 5-7. American Society of Lubrication Engineers. Annual Meeting and Exhibition. Hotel Netherland Plaza, Cincinnati.

•

April 12-15. Society of Automotive Engineers, Inc. Aeronautic Meeting and Forum. Hotel Statler, New York City.

•

April 19-20. Symposium on Automatic Production of Electronic Equipment, co-sponsored by Stanford Research Institute and the U. S. Air Force. Farimont Hotel, San Francisco.

•

April 21-23. Conference on Feedback Control Systems, American Institute of Electrical Engineers. Hotel Claridge, Atlantic City.

•

April 26-28. Metal Powder Association. Annual Meeting. Chicago.

•

April 26-30. American Society of Tool Engineers. Industrial Exposition and Annual Meeting. Philadelphia.

•

May 4-7. American Welding Society. Exposition and Spring Technical Meeting. Buffalo, N. Y.

•

May 8-14. American Foundrymen's Society. Annual Convention. Cleveland.

•

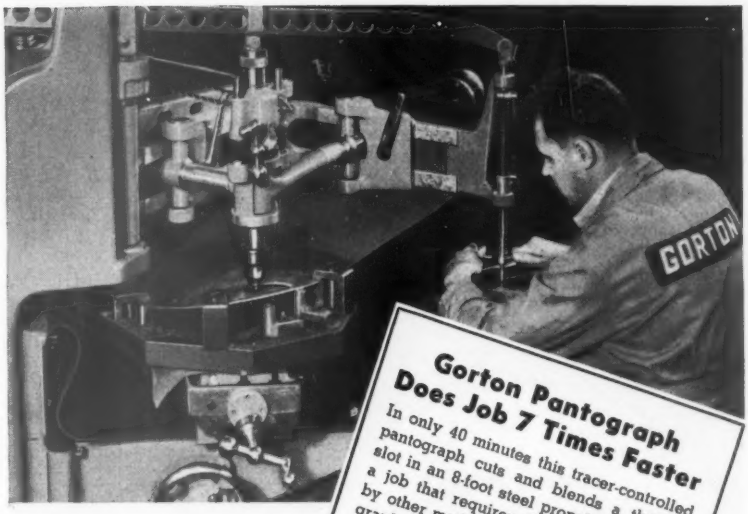
May 16-20. Basic Materials Exposition and Conference. Clapp & Poliak. Chicago.

•

May 24-27. Symposium on Instrumentation, Institute of Industrial Health, University of Michigan. Ann Arbor, Mich.

•

June 16-18. High Vacuum Symposium, Committee on Vacuum Techniques. Berkeley Cartaret Hotel, Asbury Park, N. J.



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Gorton Pantography works in two or three dimensions, in all directions on a horizontal plane, and vertically. It uses enlarged masters, templates or patterns — easily and inexpensively made. Normal operation takes advantage of the reduction ratio principle for increased accuracy in the work piece — an exclusive pantograph benefit.

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Lathe Production Featured In New Machine Tool Film

Prepared for showing before groups interested in the technical aspects of machine tool manufacture, a new 16 mm., full-color, sound film—with a running time of about 33 minutes—dramatically points up the "why" and 'how" behind modern lathe production in a modern machine tool plant.

The film selectively shows the development of new equipment designs and focuses attention on the quality control methods utilized in building a complete line of turning machines. A number of unusual production operations and plant procedures relating to lathe manufacture also pass in graphic review.

Prints of this new film for showing are available on a free loan basis. Requests should be made on business letterheads to the Monarch Machine Tool Company, Sidney, Ohio.

Patterson Urges Early Planning of Industrial Careers

The failure of many young men to plan for careers in industry because they may be called up for military service soon was termed a short-sighted policy by W. F. Patterson, director of the U. S. Department of Labor's Bureau of Apprenticeship.

Speaking at the recent apprentice graduation dinner of the Textile Machine Works at the Wyomissing, Penn., Polytechnic Institute, he said:

"Unfortunately many young men just out of school feel that because they may be in the Armed Forces soon, there is little point in their doing any planning about a career in industry. Those without a goal feel that they might as well go out and have a good time, and forget about their careers until they have completed their military service. This is a short-sighted attitude.

"In the first place, they are not developing any skills that might be useful to them in the Armed Forces, or in civilian life after they have completed their military service.

"Perhaps the worst aspect of the failure of young people to do any planning for their future while awaiting induction into the Armed Forces is that they are not developing any roots in the communities in which they live. Unless a young man has started his career as a craftsman by taking a job as an apprentice, or has made a fairly good start in some other occupation with a future, he has nothing worthwhile to come back to.

It is interesting to note, in this connection, that a study conducted recently by the U. S. Department of Agriculture, shows that a very high proportion of veterans who owned farms, or who had some prospect of owning or operating farms, returned to the farms after their discharge from military service. In contrast, a very small proportion of the 'hired hands' returned to agricultural work.

"Beginning an apprenticeship at the age of 17 or 18 would permit a young man to complete most of his training before being called for military service. Young men 17 or 18 years of age normally have 2 years or more before they are inducted.

"It is understandable that there should be some reluctance on the part of young persons to accept military deferment. Service to one's country, however, should not be thought of as just a short run obligation that can be satisfied by 2 or 3 year's service, but as a life-time obligation.

"The present unsettled world situation will probably last for many years. The young man who accepts a short deferment in order to complete his apprenticeship will have adequate opportunity to serve in the Armed Forces. What is more important, he will be able to give better service if he takes into the military service highly developed skills."

Universal Gear Tester

A new two-flank universal gear tester for the inspection of all types of fine pitch gears, including those of the smallest dimension, is being introduced in the United States.

. . . *Continued on page 92*

FIND OUT HOW YOU CAN

CUT COSTS with Rockwell* Air-Hydraulic Drill Units

*(Originally produced by Rockwell under the trade name "Delta.")

GET THE COMPLETE STORY NOW!

The Rockwell Air-Hydraulic Drill Unit is a hydraulically controlled, precision packaged power unit that provides positive automatic control of length of rapid approach, feed, and depth, for drilling, tapping and other production operations. It operates in any position, either singly or in multiples, electrically interlocked with other units or mechanisms, and can be operated by unskilled personnel with a minimum of training.

In hundreds of plants, in countless varied operations, it is cutting time, motion, and labor costs out of high-speed precision machining—creating important savings impossible with conventional equipment!

It can do the same for *you*. If your production involves drilling, tapping, threading, reaming, spot-facing, centering, counter-sinking, hollow milling, chamfering, or even milling and boring, with proper tooling, get the complete story of the Rockwell Air-Hydraulic Drill Unit now!

SEND FOR NEW DRILL UNIT BOOK TODAY

The Rockwell Drill Unit Catalog is more than a collection of specifications. *It is the complete story of a new kind of production.* It tells what the Rockwell Drill Unit is, how it operates, where it can be used, and how it can give you the cost-cutting advantages of *Automation*—so important today in the face of stiffening competition. And it includes actual case histories of applications in which the Rockwell Drill Unit *is* cutting costs for its users.

SEND THE COUPON today for your copy of the Drill Unit Catalog. It will cost you nothing, and can pay big dividends. Authorized dealers in every major city in the United States and Canada have demonstrator units on hand. Ask for details.

Air-Hydraulic **DRILL UNITS**
Another Product by **ROCKWELL**

Drill Unit Division, Rockwell Manufacturing Company
622C N. Lexington Ave., Pittsburgh 8, Pa.

☐ Please send Rockwell Drill Unit Catalog immediately.
☐ Please arrange for a demonstration in my plant.

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CIRCLE INFORM-A-GRAM KEY No. 89

Offices in Principal Industrial Areas

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SIEWEK
PRODUCTS
SAVE YOU
TIME and MONEY!

TOGGLE PADS
Toggle pads have 20° included angle of movement. Another Siewek exclusive is that they are available in National coarse and National fine threads.

TORQUE SCREWS
Over-tightening is impossible in the Siewek Torque Screw. Distortion of part piece is prevented by freely moving head when set pressure is reached. Dis-assembly for cleaning is simple.

SPRING STOPS
Sizes offer: Stroke from 3/16" to 1/4". End Pressure—14 lbs. to 32 lbs.

SPRING PLUNGERS
Only Siewek has this exclusive feature in Spring Plungers—the hardened drill-rod nose.

SEE SIEWEK
BOOTH 408
AT THE
TOOL SHOW

WRITE TODAY for CATALOG NO. 8
COMPLETE with full size Tracing Template Sheets.

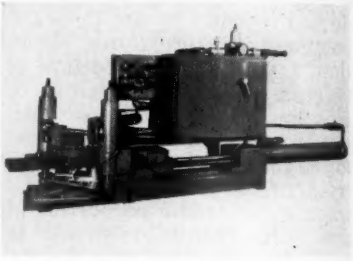
SIEWEK TOOL CO.
2863 E. GRAND BLVD.
DETROIT 2, MICH.

CIRCLE INFORM-A-GRAM KEY No. 90

Broaching Two Non-Parallel Slots Simultaneously

A new air powered horizontal broaching fixture designed and built by a Detroit broach manufacturer, simultaneously broaches two non-parallel slots in a die cast aluminum washing machine gear case cover.

The 1/8" by 1/8" slots, which are provided in the part to guide control bars, are located at a 10° angle to each other. The new broach fixture, Figure 1, produces the slots in a fraction of the time required by a former double milling operation. Only 8 seconds are required to load, broach and unload the part.



Photos courtesy National Broach & Machine Co.

Fig. 1. The new air powered broaching fixture is shown which simultaneously broaches two non-parallel slots in a die cast aluminum gear housing cover.

Simultaneous broaching of the non-parallel slots is achieved by an ingenious broach puller design in which each broach is attached to individual joint type yokes, Figure 2. The yokes are mounted on their shafts with linear ball bushings that permit free sideway movement of the yokes in relation to each other.

The broaches are mounted in broach holders that are guided in slides above the part. Thus, as the broaches are pulled through the angular slots, they are guided in the correct angular paths and the yoke members mounted on the puller head can spread apart on the cutting stroke and move toward each other on the broach return stroke.

Fixture Operation

To broach the two slots in the gear case cover, it is loaded over a locating pin and swung under the broaches against an interlocked Micro-Switch that indicates correct radial location.

With the part in correct position, the cycle start button is pressed and an automatic broaching cycle is initiated. A platform carrying the part is raised by an air cylinder-controlled rack, pinion and eccentric cam mechanism, then a spring loaded clamping plunger locator enters an-

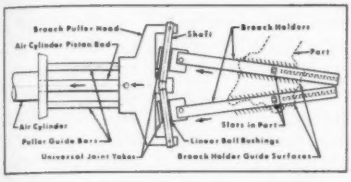


Fig. 2. A schematic drawing of the fixture showing how linear ball bushing, universal joint yokes, mounted on individual angular shafts on the puller head permit one air cylinder to pull the two guided broaches simultaneously across the part in angular paths.

other hole in the part from above. An adjustable stop controlling the vertical travel of the platform provides the broach depth adjustment.

When the platform reaches the end of the vertical travel, another switch is contacted which initiates the broach cutting stroke. An air cylinder on the end of the fixture pulls the broaches through the part. When the broaches reach the end of their stroke, another switch is actuated, the platform drops, the broach returns to its initial position, and the part is unloaded from the fixture.

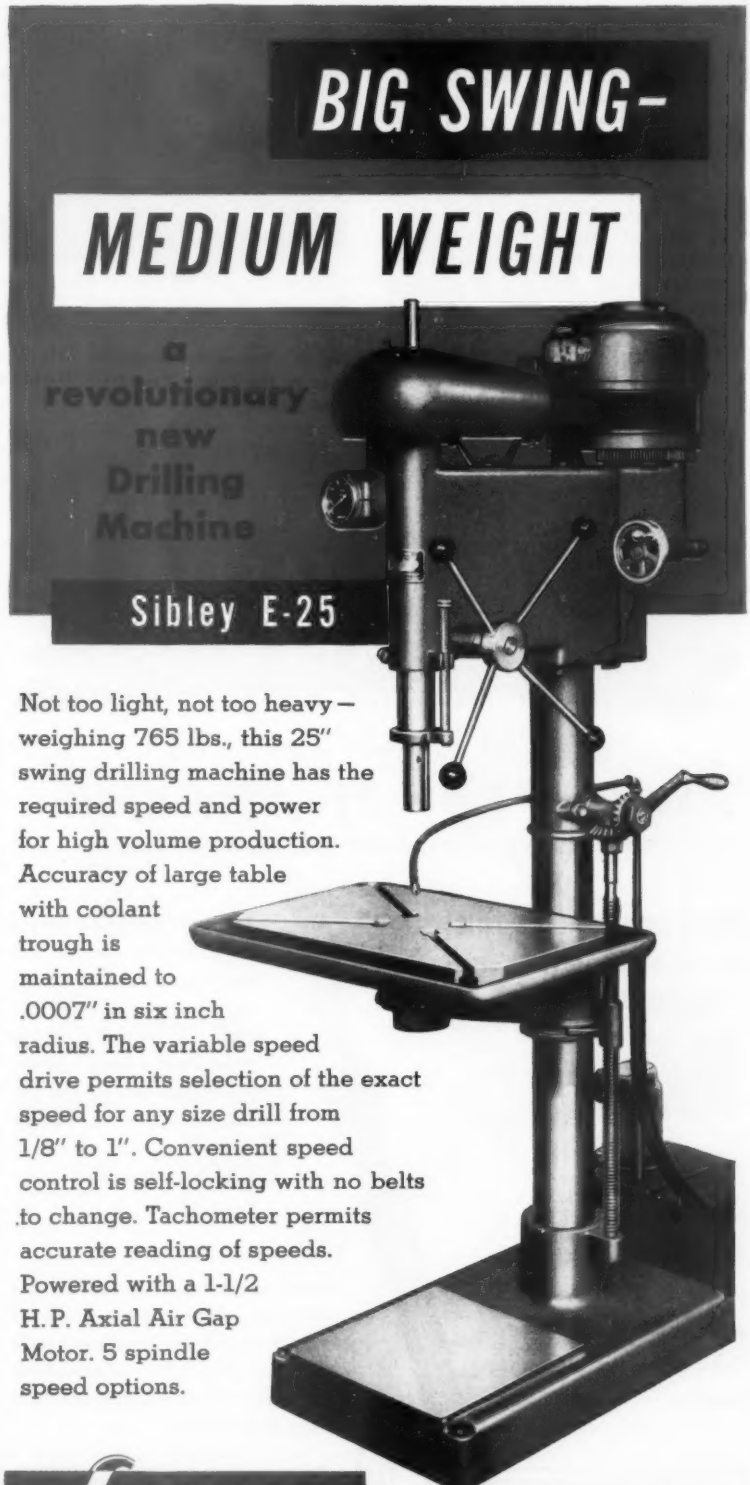
Chips are removed from the broaches and fixture both during and following the broaching operation by automatically controlled air blasts.

Fixture Specifications

The 12″ long high speed steel slot broaches are clamped in broach holders that facilitate removal for sharpening and reduce tool cost. The fixture has a cast iron base on which the operating air cylinder, platform raising mechanism, welded steel control cabinet and pushbutton control panel are mounted.

All air and electrical controls are mounted in the cabinet according to JIC specifications.

A 2″ dia. air cylinder operates the platform raising mechanism and a 4″ dia. air cylinder pulls the broaches through the part. The fixture is approximately 7′ long, 3′ high and 2′ wide. It weighs about 800 pounds.



Not too light, not too heavy—weighing 765 lbs., this 25″ swing drilling machine has the required speed and power for high volume production. Accuracy of large table with coolant trough is maintained to .0007″ in six inch radius. The variable speed drive permits selection of the exact speed for any size drill from 1/8″ to 1″. Convenient speed control is self-locking with no belts to change. Tachometer permits accurate reading of speeds. Powered with a 1-1/2 H.P. Axial Air Gap Motor. 5 spindle speed options.

SIBLEY MACHINE & FOUNDRY CORP.
10 E. Tutt St., South Bend 23, Indiana
Send Catalog No. 69, Free!

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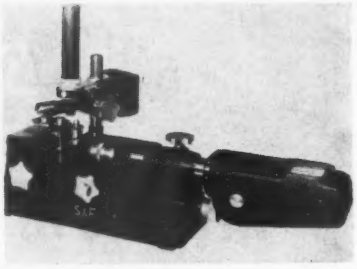
Company _____
Address _____
City _____ State _____

CIRCLE INFORM-A-GRAM KEY No. 91

. . . Gear Tester, from page 89

Unlike domestic equipment, which is designed to test one particular type gear, the S & F Gear Tester can be used for the inspection of spur, bevel and helical gears; worms and worm gears; flat and round racks; pinion shafts; finished and semi-finished gear assemblies; and extremely small gears and pinions used in instruments and dial gauges.

Operating on the principle recommended in the American Standard Inspection of fine pitch gears — the rotation of the test gear in contact with a master gear — both flanks of the test gear in the S & F Tester are in contact with the master, so that the gears mesh without backlash. The basic instrument provides for visual indication, on a dial with a sensitivity of 1/10,000, of all the errors affecting the actual performance of a gear under operating conditions. These errors are indicated as total composite error, which is made up of runout (including lateral runout or wobble) and tooth-to-tooth composite error, which is the combined effect of circular pitch error, tooth-thickness variation and profile error.



Photos courtesy Kurt Orban Company, Inc.

Fig. 1. Set-up for inspection of a spur gear in the S & F Two-Flank Universal Gear Tester.

Addition of a "Graphotest" mechanical recording instrument provides a permanent graphic recording of errors, simplifies the analysis of the total composite error into its components of runout and tooth-to-tooth composite error. Magnifications of 100, 200, 250, or 400 times are available in the Graphotest record.

The S & F Tester provides both exceptional sensitivity necessary for laboratory work and the ease of use required for production testing. The smallest gear center distances can be obtained without additional clamping fixtures or angle blocks. Simple arbors with cylindrical shafts are used for holding the gears; no tapered shafts are required. Height of gears is adjusted by means of V-blocks (prismatic guides) and clamping knobs.

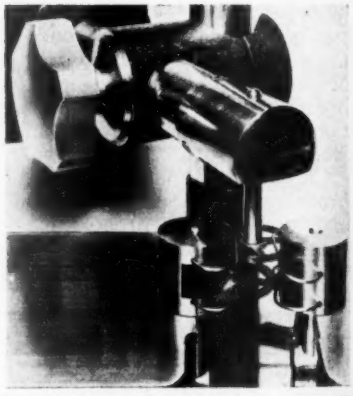


Fig. 2. Set-up for testing of very small gears with needle bearings for .012" diameter shaft in the S & F Tester. Gears with their pinions are held in small V-ways and clamped by spring type wires.

It can be supplied for either hand or motor-driven rotation of the gears. For high-production testing, a semi-automatic model

MAKE STEP-CAVITIES BETTER -- FASTER CHEAPER

with

Subland Tools by Mohawk

world's largest producer of Subland Tools

MAKE SAVINGS LIKE THIS:

9c per 100 step-cavities using MOHAWK Subland Tools compared to 34c per 100 step-cavities by any other method

Each MOHAWK Subland Tool diameter has its own set of flutes with the right spiral, rake and chip clearance, providing overlapping cutting edges which assure longer tool life than can be expected from conventional step tools.

MOHAWK Subland Tools can be made to perform from 2 to 9 operations at one time. Concentricity guaranteed.

Send us part prints or sketches showing shank and over-all length requirements along with all other pertinent information. We will submit a firm quotation including prints.

Mohawk TOOLS, INC.

910 East Main St. • Phone 402 • Montpelier, Ohio

CIRCLE INFORM-A-GRAM KEY No. 92

can be furnished. In this model, the only manual operation is the changing of the test gears. The entire test operation is then carried out on a predetermined cycle.

Basically, the instrument consists of a bed; slide, which carries the test gear; and a measuring slide carrier for the measuring slide and master gear. Bed slide and measuring slide carrier are mounted on a common base.

Interchangeable bed slides are available to adapt it to the inspection of various types of gears. The bed slide for spur gears carries an additional V-block which permits the testing of gears up to center distances of 5⅛ inches. A second type of slide is used for testing pinion shafts. A slide for bevel gears can be adapted by use of a tailstock fixture for the inspection of worms and worm gears, and by an angle piece for testing flat and round racks. For the inspection of assemblies of gears with shafts and bearings, the bed slide is removed, and the bed and measuring slide carrier used separately.

The measuring slide travels on ball bearings with pressure maintained by a flat spring in the measuring slide carrier. Total travel of the measuring slide is ⅛", controlled by a knob and threaded spindle for setting of required center distance. Overload clutch between knob and spindle prevents excessive clamping pressure and possible damage to gears. Slide can be clamped at any point within the limits of its travel.

The measuring slide is adjustably spring loaded, with pressures ranging from 0 to 8 ounces in either direction. This feature permits adjustment of pressure both for physical strength of the gears for the inspection of external or internal gears.

Provision is also made on the measuring slide for mounting of the indicator dial or for attachment to the Graphotest recorder.

Because the S & F is specifically built for the inspection of small gears, many of which are made of relatively low-strength materials, a number of design features have been incorporated to increase sensitivity, prevent inaccurate readings and eliminate the risk of deformation of the gears.

Measuring slide is of small size and light weight for extreme sensitivity. The gears are illuminated from below through a green glass window on the top of the work bench to which the instrument is bolted. This illumination enables the operator to see that the gears are meshing correctly, and thus helps in preventing any shock or pressure that might cause tooth deformation. Illumination also discloses the presence of any dirt or chips that could cause inaccurate readings. If desired, a 30-power microscope can be fitted on top for closer observation.

Compression Springs Calibrated with Pressure Gage

An inexpensive and simple way of testing compression coil springs has been developed by the Farris Engineering Corporation of Palisades Park, New Jersey, manufacturers of precision safety and relief valves.

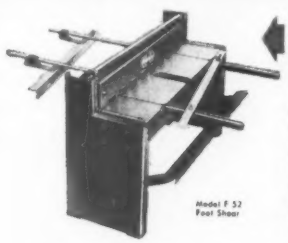
The accompanying photograph shows this new method of operation, a description of which is as

. . . *Continued on page 118*

Announcing a NEW SHEAR LINE by...

famco

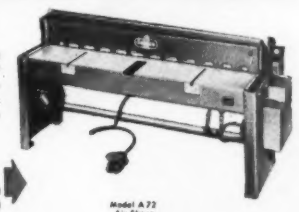
● 18 FOOT, AIR AND POWER-DRIVEN MODELS CUT 14-20 GAUGE



Model F 52 Foot Shear

Foot Shears in 6 models

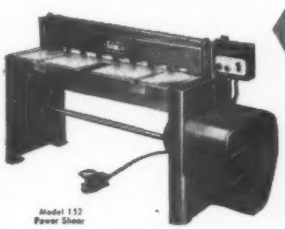
Capacity: 16 gauge mild steel in 36", 42" and 52" widths, and 18 gauge in 22", 30" and 72" widths. All-steel box-type construction.



Model A 72 Air Shear

Air Shears in 4 models

Capacity: 16 gauge mild steel in 36", 42", 52" and 72" widths. Feature low initial cost, ease of operation.

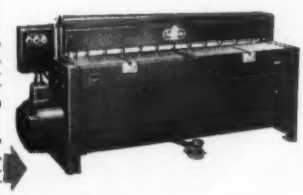


Model 152 Power Shear

Power Shears in 8 models

Capacity: 18 and 20 gauge mild steel in 36", 42", 52" and 72" widths. Feature "Electromatic Clutch" with faster operating speeds.

Capacity: 14 and 16 gauge mild steel in 36", 42", 52" and 72" widths. Feature "Electromatic Clutch" and rugged gear transmission, roller bearing equipped.



Model 1672 Power Shear

The new Famco complete Shear Line brings to American Industry new, modern concepts in Foot, Air, and Power Shear features, efficiency and design at new savings in time and money. Famco has anticipated future shear developments such as all-steel construction possessing new rigidity and inert structural strength; four-edged alloy blades; and exclusive Famco "Electromatic" clutch . . . the electrically operated 9-point jaw clutch . In addition, Famco controls produce a new high in safety factor levels, never before possible with this type of equipment. For further details, see your dealer or write for free catalog.

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3124 SHERIDAN ROAD • KENOSHA, WISCONSIN

AIR PRESSES • ARBOR PRESSES • BAND SAWS • DRILL PRESSES • FOOT PRESSES • POWER PRESSES • SQUARING SHEARS

CIRCLE INFORM-A-GRAM KEY No. 93

For Ease and Convenience Use TOOLING and PRODUCTION Inform-A-Gram Cards

Cincinnati Heavy Duty Universal Spiral Milling Attachments have many features of values for miscellaneous milling operations requiring the cutter spindle adjusted to any angle in the horizontal or vertical planes. Write to the Cincinnati Milling Machine Co., Cincinnati 9, Ohio for illustrated literature, including specifications.
Circle Inform-A-Gram No. B1.

Bearing Selection. Basic technical data, facilitating selection of the proper bearings for any installation, is featured in Torrington's new Catalog 61 on heavy duty needle bearings. The catalog also covers design features, sealing and lubrication. It is offered by The Torrington Co., Bantam Bearings Div., South Bend 21, Ind.
Circle Inform-A-Gram No. B2.

When you "SAVE"...
YOU LOSE!
"Saving" by making your own punches is old-fashioned and expensive.
Here's why:
1. PORTER PUNCHES are available for immediate delivery.
..... they save time — money — by keeping your expensive help at profitable jobs.
2. PORTER PUNCHES are made to "stand the gaff."
..... punches made in your shop are probably made from "available" material ... often the wrong metal for the job.
3. PORTER PUNCHES are offered in standard—and decimal sizes.
..... so your experienced help doesn't spend costly time "whittling."
4. PORTER PUNCHES are reasonably priced.
..... only a "specialist" can make punches as well—or as inexpensively.
Check your labor costs — your "down-time"— and order
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Save time — save money — with top quality punches and die buttons.
Look to Porter for
the punch you need... when you need it!
Remember — you don't save by making your own punches — you lose.
Still the best performer
PORTER PRECISION PRODUCTS
Princeton 5338
P.O. Box 208
Cincinnati 15, Ohio
Porter Punches are in stock in all principal cities.
CIRCLE INFORM-A-GRAM KEY No. 94

"How 18 Steel Problems Were Solved . . ." is the title of a booklet that has a collection of important case histories of "problems solved" with Timken Seamless Steel Tubing. The publication is available from The Timken Roller Bearing Co., Steel & Tube Div., Canton 6, Ohio.
Circle Inform-A-Gram No. B3.

Die Cushion Reference Book. This is a general reference book on Bliss Marquette Die Cushions and allied equipment. It is intended as an aid in understanding a few of the various uses of die cushions as well as their maintenance and day-to-day operations. The book is offered by the E. W. Bliss Co., Canton 6, Ohio.
Circle Inform-A-Gram No. B4.

Toggle Clamps. WESPO announces a new complete line of toggle clamps especially designed for fast, sure and positive work-holding; efficient clamping; and extra long clamp life. A template catalog available tells all. The address is West Point Mfg. Co., 26935 W. 7 Mile Rd., Detroit 19, Mich.
Circle Inform-A-Gram No. B5.

Power and Capacity for every baling need is assured with Galland-Henning Triple Compression baling presses. A well-illustrated bulletin (3591-TC) giving salient features of these machines is available from the Galland-Henning Mfg. Co., 2753 S. 31st St., Milwaukee 46, Wis.
Circle Inform-A-Gram No. B6.

Coolant Filters. A new folder is now available on Delpark coolant filters for Micromatic equipment. It contains data on late model Micromatic machines and the Delpark Filters offered as optional equipment. The folder is offered by the Industrial Filtration Co., Dept. M299, Lebanon, Ind.
Circle Inform-A-Gram No. B7.

A New Bulletin on Engineered Structural Shapes has just been issued by Kling Bros. Engineering Works, 1320 N. Kostner Ave., Chicago, Ill. These shapes consist of rolled or formed angles, beams, channels, bars or rails of steel, aluminum or brass which are used to replace casting or plate cutting methods formerly used. Some of the purposes for which these curved structural shapes are used include wheels, exhaust fan rings, bullwheels and pulleys, racks for pinions, and reinforcements for various purposes such as arched doorways, barrels, tanks, or smoke stacks and furnaces.
Circle Inform-A-Gram No. B8.

TOOLING and PRODUCTION'S Inform-A-Gram Section is a CARDload of Information

A Selection Guide is one of the features of a new and fully illustrated catalog issued on one to 50 hp AC motors recently introduced in the United States. To facilitate selection of the right motor for the job, a quickly visualized chart of

electrical and mechanical features of standard and special motors also is included in the catalog. Copies available on request to Brook Motor Corp., 3555 W. Peterson Ave., Chicago 45, Ill., or.....

Circle Inform-A-Gram No. B9.

Hill Pneumatic Riveting Machines for high speed production riveting are described in a folder now available from the Hill Machine Co., 1301 Eddy Ave., Rockford, Ill. Illustrations, specifications and prices are included in the literature.

Circle Inform-A-Gram No. B10.

DoAll's Complete Milling Cutter Line is presented in new literature just released by the firm. Among the variety of products described are slitting saws, screw slotting saws, shell end mills, end mills, keyseat cutters, T-slot cutters and counterbores. The literature is available from The DoAll Co., Des Plaines, Ill.

Circle Inform-A-Gram No. B11.

Solid Adjustable Taps. The Landis Machine Co., Waynesboro, Pa., has revised its bulletin on solid adjustable taps to include detail data on these tools covering a tapping range from $1\frac{1}{16}$" to 9". It also contains information on the special LSA tap which taps and chamfers in one operation. Besides illustrations, dimensions and specifications are included in this brochure. If writing direct to the company, ask for Bulletin No. G-92-2.

Circle Inform-A-Gram No. B12.

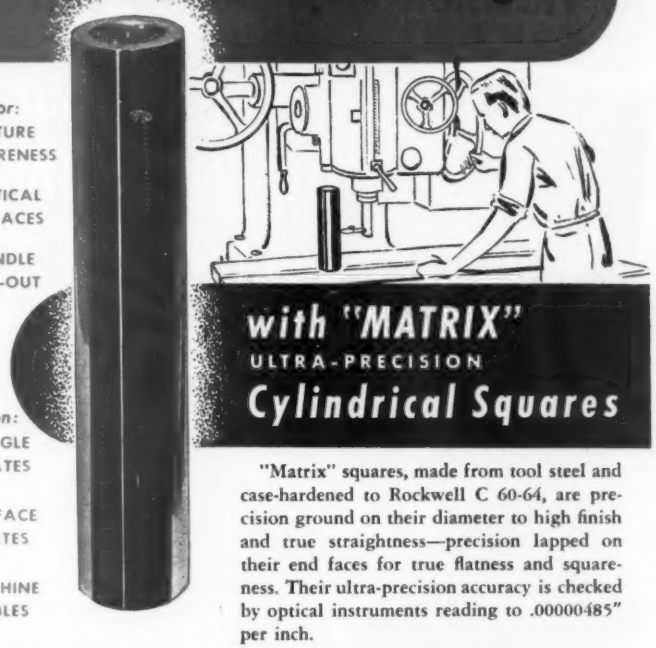
A New Line of Diaphragm Motor Control Valves, designed for use with wide-band, proportional control instruments widely used in industry, has been developed by the Industrial Division of Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa. Further information is available in the firm's Bulletin 800.

Circle Inform-A-Gram No. B13.

A New Model 84 Internal-External Grinder for more efficient small hole and cylindrical grinding is being offered by Rivett Lathe & Grinder Inc., Brighton 35, Boston, Mass. To acquaint TOOLING and PRODUCTION readers with this latest grinder, a well-illustrated and highly informative catalog (Bulletin No. 84A) is available.

Circle Inform-A-Gram No. B14.

Fast Reliable Checking...



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ULTRA-PRECISION
Cylindrical Squares

"Matrix" squares, made from tool steel and case-hardened to Rockwell C 60-64, are precision ground on their diameter to high finish and true straightness—precision lapped on their end faces for true flatness and squareness. Their ultra-precision accuracy is checked by optical instruments reading to .00000485" per inch.

"ONE OF THE MOST USEFUL AND ACCURATE TOOLS . . ."

At J. P. Seeburg Corp., Chicago, cylindrical squares serve a multitude of uses. Mr. S. Chidel, in charge of the Gage Engineering Department, says "precision cylindrical squares are among the most useful and accurate checking tools in the shop, tool room, and inspection departments, for checking angle plates, vee blocks, steel squares, vertical spindle travel and run-out, flat beds for concavity or convexity; for squaring fixtures or use on surface plates and machine tables. They give the security of a master unit."

LENGTHS: 3 TO 36 INCHES
ACCURACY: .00003" TO .00008"

Exactness of "Matrix" Cylindrical squares is *guaranteed* as to maximum deviations from straightness, squareness and parallelism. Standard lengths are 3, 6, 9, 12, 18, 24 and 36 inches; with diameters of 2, $2\frac{3}{4}$, 3, $3\frac{1}{4}$, $3\frac{3}{4}$, 4 and 7 inches.

Each square is furnished in hinged-cover hardwood case.

For Complete Details,
Write for Specification Sheet ST354

ENGIS EQUIPMENT COMPANY
431 S. Dearborn St. • Chicago 5, Ill.

CIRCLE INFORM-A-GRAM KEY No. 95

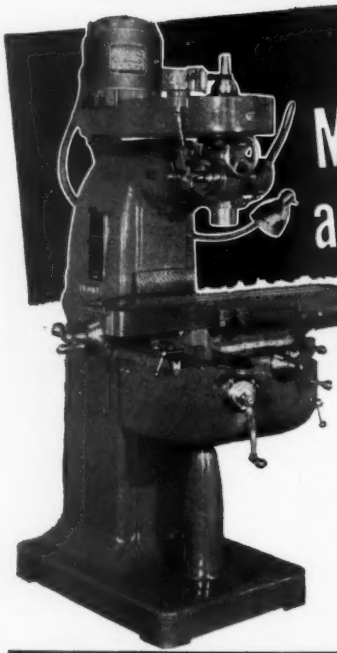
Surface Grinder. American Machinery Co., 315 Asylum St., Bridgeport, Conn., announces a surface grinder which has a 13½" clearance under the wheel and a 6½" x 16" table travel. A brochure on this machine is available.
Circle Inform-A-Gram No. B15.

"The Path to Better Brazing." This booklet tells how to produce better brazed joints besides giving silver alloy preform specifications and a ring weight calculating chart. It is available from the Lucas-Milhaupt Engineering Co., 5056 S. Lake Dr., Cudahy, Wis.
Circle Inform-A-Gram No. B16.

Electrostatic Spray Painting, its advantages and applications, is described in this illustrated brochure offered by the Ransburg Electro-Coating Corp., Indianapolis 7, Ind.
Circle Inform-A-Gram No. B17.

Engineering Data Sheet. A new 3-page engineering data sheet (Special No. 10) describing Walmang, austenitic nickel manganese steel bare and coated welding electrodes that produce a weld deposit having general characteristics of 12% manganese steel, is now available from Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich.
Circle Inform-A-Gram No. B18.

For PRECISION at Surprisingly LOW COST



Put All Your MILLING, BORING and DRILLING Jobs on INDEX MILLS

Speed up operations with INDEX MACHINES as an aid in meeting today's high pressure tool room and production plant service. They assure you peak performance while holding to the Index reputation of precision and economy . . . For those heavy-duty jobs where increased speed and feed range are required, you will find your answer in this strong, rugged MODEL 55 VERTICAL MILL (Pictured). Capacity ⅛" to 1½" end mills in steel and a table working surface of 32" x 9" or 38" x 9", Overall 40" x 9" or 46" x 9".

MODEL 40 VERTICAL MILL
A machine that emphasizes the combination of Precision, Production, and Economy . . . It embodies many features that provide for faster, more economical milling, resulting in a substantial cut in production costs . . . It is sufficiently rugged for day-to-day operation and can also be used for accurate boring and locating . . . Capacity ⅛" to 1" end mills in tool steel. Table working surface 8" x 26", 8" x 34" overall.

MODEL 60 HORIZONTAL MILL
A versatile machine with simplicity of design that permits an unusually low price while reflecting quality, accuracy and practical utility . . . A product where advanced engineering and expert craftsmanship have joined to bring out an outstanding piece of equipment adapted to tool room use, yet sufficiently rigid for the requirements of production shops . . . Standard table 40" x 9" with larger table optional. Equals or exceeds a light No. 2 in capacity.

INDEX BUILDS BETTER MILLS . . . WRITE FOR LITERATURE

INDEX MACHINE CO.

541 N. MECHANIC STREET JACKSON, MICHIGAN

CIRCLE INFORM-A-GRAM KEY No. 96

The "John's" Drill Jogs are automatic self-centering work holding devices that are, among other things, ideal for chucking on rough casting surfaces. A bulletin offered by the Heuser Mfg. Co., 1638 N. Paulina St., Chicago 22, Ill., gives plenty more uses of the versatile jigs.
Circle Inform-A-Gram No. B19.

Advantages of Cutting Oil Purification. Factual answers to the question, "Should I Purify Cutting Oil in My Shop," are given in Bulletin 1270 just released by The Sharples Corp., 2300 Westmoreland St., Philadelphia 40, Pa. Typical layouts of several cutting oil purification systems are shown, in addition to information on the Sharples line of centrifugal purifiers.
Circle Inform-A-Gram No. B20.

Water Filters. Particulars and complete data on Marvel Synclinal filters for water may be obtained in Water Filter Catalog No. 300 put out by the Marvel Engineering Co., 625 W. Jackson Blvd., Chicago 6, Ill. Maximum active filter area, longer periods of operation, no moving parts, and simplicity of maintenance are some of the features associated with the Marvel water filters.
Circle Inform-A-Gram No. B21.

Advanced Metal Working Techniques and facilities for fabricating and machining high capacity metals into strong, lightweight precision parts are described in a new brochure, "Twigg Can Do It," Published by Twigg Industries, Inc., Department P, Brazil, Ind. The colorful 20-page booklet takes you step by step through Twigg's design, engineering, development and special toolmaking departments.
Circle Inform-A-Gram No. B22.

Revised Machining Bulletin. The release of the latest revision of a 12-page bulletin, "The Machining of Ampco Metal," No. 66a, has been reported by Ampco Metal, Inc., 1745 S. 38th St., Milwaukee 46, Wis. The revised edition discusses such topics as General Machining Properties; Machining Practices; Grinding, Honing and Polishing; Milling; Broaching; Sawing; Drilling, Reaming and Tapping; and Tool Design and Inspection.
Circle Inform-A-Gram No. B23.

For Metalworking People who are looking for methods of improvements and lowering of production costs there is a brand new catalog available from the Turchan Follower Machine Co., 8259 Livernois Ave., Detroit 4, Mich. It covers hydraulic duplicating attachments for standard machine tools; Designing and building complete control systems for machines and complete new tracer-controlled machines made by Turchan.
Circle Inform-A-Gram No. B24.

R/M Super-Power V-Belts are described in a folder recently issued by Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J. The folder claims the new belts give a 40% increase in horsepower capacity, resistance to shock loads and length stability. If writing direct to the company, ask for Bulletin No. 6628.

Circle Inform-A-Gram No. B25.

Automatic Testing Controllers. Bulletin 48, just released by Tinius Olsen Testing Machine Co., 1140 Easton Rd., Willow Grove, Pa., features a new line of electronic controllers for automatic testing production and research testing programs.

Circle Inform-A-Gram No. B26.

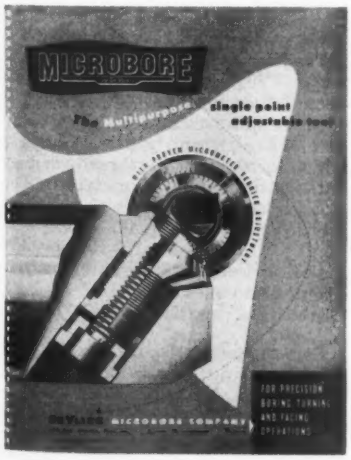
Miniature Inspection Lamps, absolutely safe to operate on A.C. current and which deliver light exactly where needed without glare, are ably described in Bulletin No. 101 available from the Eder Instrument Co., 2293 N. Clybourn Ave., Chicago 14, Ill. These lamps can be used on such metal-working products as tools and dies, castings and punch presses.

Circle Inform-A-Gram No. B27.

Sheet Lifter. A new type sheet lifter that incorporates several new patented features for safe and wide-range low head room sheet grab has been developed by the H. L. Bushman Co., 5733 W. Lake St., Chicago 44, Ill. An interesting bulletin (No. G-110) illustrates and describes this helpful and versatile handling product.

Circle Inform-A-Gram No. B28.

For Precision Boring, Turning & Facing Operation data TOOLING and PRODUCTION readers would do well to review a brand new catalog covering the subject put out by the



DeVlieg Microbore Co., 450 Fair Ave., Ferndale 20, Mich. The bulletin gives general information on the Microbore multipurpose single point adjustable tool with engineering data and grinding instructions.

Circle Inform-A-Gram No. B29.

Precision Tools. Calipers, squares, micrometers and dial indicators are illustrated and described in the latest circular offered by the Foster Supplies Co., 6122 Milwaukee Ave., Chicago 30, Ill.

Circle Inform-A-Gram No. B30.

Production Leak-Testing The Moore system for this process is discussed in Application Bulletin AB-4 now being offered by Moore Products Co., H. & Lycoming Sts., Philadelphia 24, Pa. Diagrams help explain the principle of operation, advantages and proved components of this system. **Inform-A-Gram No. B31.**

Automatic Production Control. This 24-page booklet (Bulletin G-537) covers the complete line of automatic controls available on Reeves variable speed drives. It can be had from Reeves Pulley Co., Columbus, Ind.

Circle Inform-A-Gram No. B32.

Surface Grinding Wheels are illustrated and described in a 4-page folder offered by the Bay State Abrasive Products Co., Westboro, Mass. Specifications on straight wheels, cups or cylinders and segments are included.

Circle Inform-A-Gram No. B33.

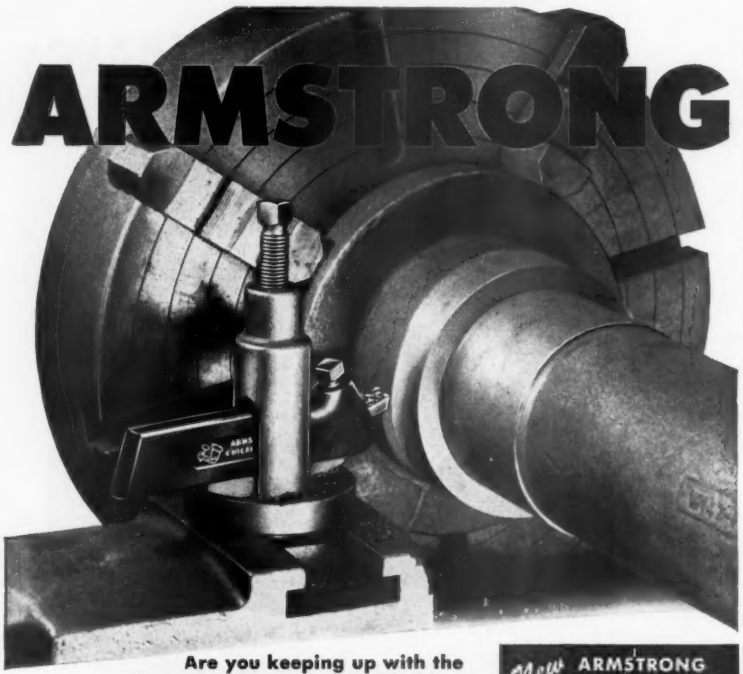
POSITIVE DR CK CHANGE
with Continental Counterbores . . .
You can reduce your tool cost, improve accuracy, and increase production with the Continental complete line of standard drive interchangeable cutting tools. Cutters have a balanced, indestructible drive—originated by Continental—that will not stick, will not break, and is hand detachable after toughest cuts.
Order through your local Ex-Cell-O representative or write to Continental in Detroit.
CONTINENTAL TOOL WORKS
Division of Ex-Cell-O Corporation
DETROIT 32, MICHIGAN

CIRCLE INFORM-A-GRAM KEY No. 97

Power Transmission Equipment and components, more than a 100 strong, are listed in Catalog 55 put out by the Boston Gear Works, 14 Haywood St., Quincy 71, Mass. Also an engineering section in this booklet contains 18 pages of engineering formulas, tables and descriptive text. Supplementing this engineering section are selection charts and horsepower ratings located in product sections of the catalog. They are arranged and placed so as to aid in the selection of any individual item of the stock group to which they apply.
Circle Inform-A-Gram No. B34.

Handling Devices. A new 4-page brochure on American Cranehands, automatic mechanical handling devices, now is available from the American Forge and Mfg. Co., 818 Shore Ave., Pittsburgh 12, Pa.
Circle Inform-A-Gram No. B35.

Flexible-Power Presses, accessories and straightening attachments are illustrated and described in Bulletin 401 offered by the General Mfg. Co., 6430 Farnsworth Ave., Detroit 11, Mich. Six of the usual operations performed on the presses also are shown.
Circle Inform-A-Gram No. B36.



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

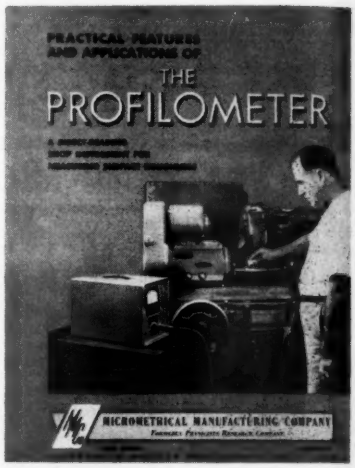
New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C.A." Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

WRITE FOR CATALOG

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5220 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

CIRCLE INFORM-A-GRAM KEY No. 98

This 8-page illustrated bulletin on the Profilometer for measuring surface roughness has just been released by the Micrometrical Mfg. Co., Ann Arbor, Mich. Identified as



Bulletin LT89, it describes the Profilometer's features from the user's standpoint and explains the why and how of the instruments versatility. Typical applications in well-known plants, also, are included.
Circle Inform-A-Gram No. B37.

For Your Information, TOOLING and PRODUCTION readers, a highly informative "facilities bulletin" is offered by Rockford Die and Tool Works, Inc., of Rockford, Ill. In addition to photographs of such departmental activities and equipment as milling, grinding, turret lathe and inspection, the brochure shows a great variety of precision tools and production parts which are indicative of the firm's ability in fulfilling customers' needs.
Circle Inform-A-Gram No. B38.

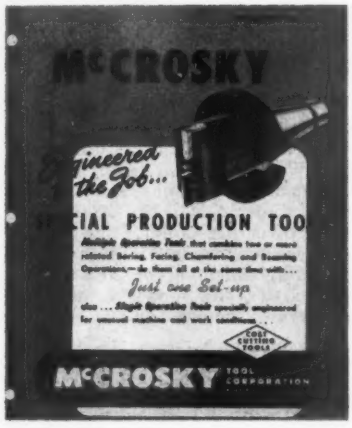
Tapping Screws. An 8-page booklet on "Tapping Screws" has just been issued by the Townsend Co., New Brighton, Pa. It describes in detail 7 different types of screws which form their own threads as they enter various types of materials. The Booklet (No. TL-88) also relates how the tapping screws make quick, economical and secure fastenings in materials ranging from plywood to plastics and metals.
Circle Inform-A-Gram No. B39.

Self-Centering Drill Turret. Just published by Howe & Fant, Inc., 521 Flaxhill Rd., Norwalk, Conn., is Bulletin 5312 explaining the new Flying Dutchman positive drive, now incorporated in all Model "E" Lign-o-matic R drill press turrets. According to the new bulletin, one man using the Lign-o-matic, self-centering turret, can perform six consecutive drill press operations on a single drill press spindle.
Circle Inform-A-Gram No. B-40.

Bearcat Tool Steel. This booklet contains considerable detail on the hot-work and easy machining ability of Bearcat Steel. The publication is presented by the Bethlehem Steel Co., Bethlehem, Pa.
Circle Inform-A-Gram No. B41.

Magnetic Contractors are described in literature presented by the Federal Electric Products Co., 50 Paris St., Newark 5, N. J. The bulletin, No. 502, gives complete information on Federal's magnetic contractors, including dimensions and weights.
Circle Inform-A-Gram No. B42.

Special Production Tools. You'll want this 16-page illustrated brochure because it gives data on multiple operation tools that combine two or more related boring, facing,



chamfering and reaming operations into just one set-up. This special production tools booklet can be had by writing direct to the McCrosky Tool Corp., Meadville, Pa., or—
Circle Inform-A-Gram No. B43.

Emulsion Cleaners. Complete literature on a new emulsion cleaner plus an "Emulsion Cleaner Reference Chart" which includes specific industrial uses, maximum and minimum dilution ratios, diluents used, methods of application, flash points and safety factors are contained in Catalog A-106 now being distributed by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif.
Circle Inform-A-Gram No. B44.

Horizontal Double End Machines that can bore, chamfer, burr, mill, center, flare or spin tubular and solid metal parts at production rates up to 6,000 pieces are the theme of this illustrated catalog sheet. Operating descriptions, application data and machine specifications as well as a line drawing and description of the Hill hydraulic power head that resists thrust loads up to 14,000 lbs. are included. The catalog is available from Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, Mich.
Circle Inform-A-Gram No. B45.

Rotary Tools for Strand flexible shaft machines are put on display in this well-presented brochure of the Franklin Balmar Corp., N. A. Strand Div., Woodbury, Baltimore 11, Md.
Circle Inform-A-Gram No. B46.

Barker Bench Type Mills are illustrated and described in a new circular now available from the Barker Engineering Corp., 500 Green Rd., Cleveland 21, Ohio. These machines are noted for their versatility in performing a multitude of operations on small parts.
Circle Inform-A-Gram No. B47.

Milling Machines. Here is a 14-page catalog illustrating and ably describing SAJO Millers Models 48 and 49 and accessories. It is available from the Austin Industrial Corp., 76 Mamaroneck Ave., P. O. Box 430, White Plains, N. Y.
Circle Inform-A-Gram No. B48.

A Flexible Coupling catalog, available from the Lovejoy Flexible Coupling Co., 4945 W. Lake St., Chicago 14, Ill., gives details and specifications on coupling cushions, besides similar data on the couplings themselves.
Circle Inform-A-Gram No. B49.

NEW
40,000 RPM
ROTOR PENCIL GRINDER
pays for itself
in 3½ weeks
AIR
PENCIL GRINDER FACTS
WEIGHT . . . . . 13 ounces
LENGTH . . . . . 5¾"
DIAMETER . . . . . 1"
FREE SPEED . . . . . 40,000 RPM
COLLET . . . . . ⅛" or ¼"
For dies, patterns and 1001 grinding jobs.
JOB—High pressure ½" diam. tubing for condensers—grind welds smooth. Used heavier die grinders. Took 15 minutes per weld.
SOLUTION—Tried new Rotor Pencil Grinder. Operates at 40,000 RPM.
RESULTS—Grinding time cut 7 minutes per weld, or 46.5%. This "pay-off" amounts to $22.32 per week—pays for grinder in 3½ weeks. Mounted points last twice as long, adding to savings. Customer bought 8 Rotor Pencil Grinders.
Find out how this new grinder and other new Rotor Tools can save you time and money! Ask for a demonstration.
SCREW DRIVER
THE ROTOR TOOL CO.
CLEVELAND OHIO
IMPACT WRENCH
CIRCLE INFORM-A-GRAM KEY No. 99

A New Small Flexible Shaft Machine Bulletin (No. 536) shows four small light-weight flexible shaft machines made by the Stow Mfg. Co., 82 Shear St., Binghamton, N. Y.

Circle Inform-A-Gram No. B50.

Induction Heating Generators. The new Ther-Monic electronic induction heating generator is small, compact and low in cost. It can be used for brazing, soldering, hardening, annealing and melting. Read all about it in literature available from the Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y.

Circle Inform-A-Gram No. B51.

Leaded Steel Bars. Just off the presses, is a new illustrated brochure on LaSalle Super La-Led, a fast machining steel bar. The advantages and applications of this material are ably described in Bulletin No. 8 available from the LaSalle Steel Co., 1424 150th St., Hammond, Ind.

Circle Inform-A-Gram No. B52.

Carbide Twist Drills. Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich., has released a new circular, No. 541, describing its metal cutting carbide tipped and solid carbide drill line. Complete size and net price information is given. **No. B53.**

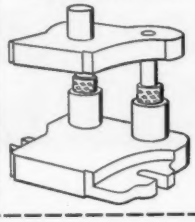
ALL NEW
LOW PRICES!

No more than 15% above old-fashioned friction types!

LEMPCO MAKES A *Complete*
BALL BEARING DIE SET LINE

LEMPCO PRODUCTS, Inc. Industrial Division , DEPT. T.P.
Dunham Road, BEDFORD, OHIO

Gentlemen: Please send me your NEW DIE SET CATALOG



Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

CIRCLE INFORM-A-GRAM KEY No. 100

Lapping, Super Finishing & Polishing are the subjects discussed in a pocket folder available from Scientific Abrasives, 5100 N. Canfield Rd., Chicago 31, Ill.

Circle Inform-A-Gram No. B54.

Magnesium & Aluminum Castings. New horizons for product improvement with these light-weight metals are scanned in an illustrated brochure offered by Rolle Mfg. Co., Inc., Lansdale, Pa.

Circle Inform-A-Gram No. B55.

Metal Stampings. Here is information on a "specialized service" for producing short run stampings for experimental and small production runs by use of temporary tools with savings in tooling up costs of up to 90 per cent. Your copy is available from the Small Lot Stamping Co., 1025 W. Blancke St., Linden, N. J.

Circle Inform-A-Gram No. B56.

Worm Gear Speed Reducers are shown in Catalog No. 1006 now available from the Eberhardt-Denver Co., 1401 W. Colfax Ave., Denver, Colo. Included is the unique new "poweR-gear" reducer which offers more horsepower per dollar. The catalog also contains valuable information regarding selection of reducers, horsepower and torque calculations and service factors.

Circle Inform-A-Gram No. B57.

Centralized Lubrication. A 20-page booklet on modern-day centralized lubrication systems is yours for the asking. The well written publication also contains good photographs. Diagrams are an added attraction in showing how the centralized system operates. Also in this bulletin, No. 26, a sequence of cut-away views give an excellent color presentation of the unique Farval Dualine valve in operation. Just off the presses, this booklet is offered by the Farval Corp., 3249 E. 80th St., Cleveland 4, Ohio.

Circle Inform-A-Gram No. B58.

A New Plastic Metal Material called "Devcon" can be used to make, in a relatively few minutes of shop time, drilling and milling jigs and fixtures, forming and drawing punches and dies, inspection fixtures, etc. "Devcon" is a putty-like substance made up of a fine steel powder and a special plastic. After it is shaped to the job, the material hardens in a couple of hours, and then can be sawed, drilled, tapped, threaded and ground. A four-page bulletin available from the Chemical Development Corp., Danvers, Mass., contains information on the physical properties and illustrates the simple steps in making a drill jig in 14 minutes.

Circle Inform-A-Gram No. 59.

"All Star Tool Catalog. Here is a handy-size booklet which gives information on mills, deburring cutters, countersinks, reamers and shanks. The catalog contains such data as prices, order information and a unique telegraphic code for ordering quickly and economically. For example, did you know that "Pipe Bird B-7264 100 ELC" means, "Enter our order B-7264 for immediate shipment by air mail for 100 ELC." This catalog is available from Severance Tool Industries, Inc., Saginaw, Mich.
Circle Inform-A-Gram No. B60.

For Small Quantity Stampings. Publication of a 4-page, 2-color brochure presenting information on die and stamping costs for small quantity stampings has been announced by the Federal Tool & Mfg. Co., 3600 Alabama Ave., Minneapolis 16, Minn. Specifications for maximum blank size, maximum blank thickness and maximum blanking pressures are listed.
Circle Inform-A-Gram No. B61.

Three-Dimensional Models. This four-page folder shows how scale models can be used to advantage in plant layout, site development, architectural and structural planning, product development and as a sales aid. Copies will be sent to readers requesting them by Knight Models, Inc., 600 W. Jackson Blvd., Chicago 6, Ill.
Circle Inform-A-Gram No. B62.

High Speed Ground Tool Bits are illustrated and described in a four-page folder put out by The duMont Corp., Greenfield, Mass. Included in the bulletin is a chart showing how major factors for tool bit performance and service compare for the various steels commonly used in tool bits.
Circle Inform-A-Gram No. B63.

Casting Impregnation. A new 8-page booklet on casting impregnation has been issued by Polyplastex International, Inc., 441 Madison Ave., New York 22, N. Y. The booklet places emphasis upon the fact the use of an impregnation system to assure density and increase the pressure tightness of castings is not a method of salvaging inferior or defective units.
Circle Inform-A-Gram No. 64.

A Combination Cutter is available that can be used for face milling, square shoulder milling, multiple step milling and for cutting steel, cast iron and non-ferrous metals. To acquaint TOOLING and PRODUCTION readers with this versatile tool, an illustrated folder is being offered by Sandvik Coromant Division of Sandvik Steel, Inc., 20005 James Couzens Highway, Detroit 35, Mich.
Circle Inform-A-Gram No. B65.

"Profits Through Effective Machine Replacement Programs," is the title of Catalog M-1776-1 now being offered by The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.
Circle Inform-A-Gram No. B66.

Two Steel Catalog Sections have been released on Firth Sterling BEST, a water hardening, carbon tool steel and Firth Sterling FS 2-5, a medium tungsten, vanadium-cobalt high speed steel. In the sections, complete data as to typical analysis and applications are presented. Write to Firth Sterling, 3113 Forbes St., Pittsburgh 30, Pa., or—
Circle Inform-A-Gram No. B67.

A New-Type Fastener has been introduced by the P-Nut Division, Waterbury Pressed Metal Co., 300 Chase Ave., Waterbury, Conn. It is self-holding, self-locking and is made of high-carbon steel. A bulletin on the new product is available.
Circle Inform-A-Gram No. B68.

Welding Jigs & Fixtures. A new 16-page bulletin containing jig and fixture modifications to present equipment and several new machines particularly designed for the tank fabrication fields is available from the Reed Engineering Co., 1033-17 W. Fairview Ave., Carthage, Mo.
Circle Inform-A-Gram No. B69.

Special U-clamps made on a DAKE press with this low-cost fixture

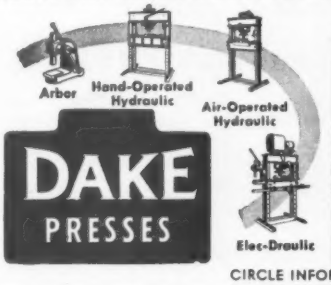
A few pieces of scrap steel, cut to size and welded, became the die with which this machinist forms U-clamps on his Dake Hydraulic Press.

He is Gerald Denicola, who operates the Marmora Machine Co. of Chicago. One of his customers orders these clamps 100 at a time, three or four times a year.

When he learned that there would be repeat orders for them, he rigged up the fixture shown above at a cost of less than $15. It paid for itself on the first run, and since then has paid "dividends" regularly every three or four months.

If you are hammering out jobs the *hard* way, imagine how much work and money you could save by doing them with a Dake Hydraulic Press. Hand, air, or electrically operated Dake Presses with capacities ranging from 25 to 300 tons are suitable for thousands of production and maintenance jobs. They are fully described in illustrated Catalog 129 —write for a copy, today.

Dake Engine Company, 634 Seventh St., Grand Haven, Mich.



Send for Big New Catalog

DAKE ENGINE COMPANY
634 Seventh St., Grand Haven, Mich.
Please send me a copy of Dake Catalog No. 129
Name _____
Company _____
Address _____
City _____ Zone ____ State ____

CIRCLE INFORM-A-GRAM KEY No. 101

MEN YOU SHOULD KNOW . . . . . .

Alfred M. Bakken

Edgar D. Leon

Joseph Lind

Henry M. Aldrich

Harold E. Collins

The P. D. Q. (Portage Double Quick) tool holder and adapter line opens a new era in quick change tools. These Portage tools not only mean new speeds in production and set-up time, but increased accuracy as well.

Send for the New P. D. Q. Catalog

PDQ **PORTAGE Double-Quick TOOL CO.**

1046 Sweitzer Avenue • Akron 11, Ohio

CIRCLE INFORM-A-GRAM KEY No. 102

Alfred M. Bakken was recently appointed general sales manager in the stamping division of the Dayton Rogers Mfg. Co. of Minneapolis, Minn. He was elevated from the firm's quality production control department where he had accumulated years of experience in the expediting of short-run stampings.

◆

Edgar D. Leon has been elected president and a director of The Gear Grinding Machine Co. of Detroit. He will assume the management and coordination of the company's three divisions; Rzeppa universal joints, grinding services, and Geargrind machines.

◆

Joseph Lind, well known combustion equipment sales engineer, has opened an office for the Burdett Mfg. Co. of Chicago in New York City. He will represent the firm in the sale of combustion and complete finishing systems in Metropolitan New York and Connecticut and New Jersey.

◆

Daco Machine & Tool Co. of Brooklyn, N. Y., manufacturer of precision instruments, reports the appointment of **Henry M. Aldrich** as director of sales. Aldrich was formerly with Reeves Instrument Corp., as a divisional sales manager.

◆

Harold E. Collins has been elected vice president of the Metals Disintegrating Co. of Elizabeth, New Jersey. In his new duties, Collins will handle the company's marketing operations in its pigments and abrasive divisions.

◆

Firth Sterling, Inc., of Pittsburgh, Pa., announces the election of **T. G. Barnes** as vice president-sales and **J. T. O'Brien** as vice president-operations. The firm also reports that **John E. Hartman** has been named assistant to the sales promotion manager.

MEN YOU SHOULD KNOW

R. W. Breckenridge

F. Pat Greene

Kenneth U. Jenks

Bernard J. Hill

John H. Harding

The Pressed Metal Institute of Cleveland, Ohio, has announced the appointment of **R. W. Breckenridge** as technical director of the Institute's new technical and engineering department.

◆

F. Pat Greene has been appointed general sales manager of Newman Industries (America) Inc. British manufacturer of electric motors with offices in New York. Greene will be responsible for the establishment of a national distribution organization for Newman products in this country.

◆

Kenneth U. Jenks, secretary and controller of the Lindberg Steel Treating Co. of Melrose Park, Ill., is now serving as a trustee of the Metal Treating Institute, (national trade association of commercial metal treating companies).

◆

Bernard J. Hill has joined the sales engineering staff of the Honan-Crane Corp. of Lebanon, Ind. He will cover Minnesota, North and South Dakota, Iowa, western Wisconsin and the Tri-Cities area with headquarters in Minneapolis.

◆

John H. Harding has recently been appointed sales manager of the Hydro-Line Mfg. Co., Rockford, Ill. Harding has been with the firm since 1951 as sales engineer. His appointment is part of a general over-all expansion program being conducted by the organization.

◆

Leslie B. Bellamy of Detroit has been named general manager of the Cleveland Quarries Company's Sterling Abrasive Division in Tiffin, Ohio.

◆

Template Reproduction and Engineering Co., Philadelphia, Pa., has announced the election of **Philip E. Spindell** as vice president, engineering and **Paul Mueller,** vice president, manufacturing.

Durable... Dependable
FIXTURE CLAMPS and FIXTURE DETAILS by Morton
IMMEDIATE DELIVERY
LARGEST ASSORTMENT IN THE INDUSTRY
BACKED BY 30 YEARS OF FINE TOOL MAKING
ECONOMIZE . . . USE THEM AS STANDARDS. All precision made of heat treated selected steel, cadmium plated and corrosion resistant MID-NITE BLACK FINISH (a special MORTON process). Individual parts or complete assemblies. Any MORTON product can be adapted to whatever changes you might specify.
MORTON
SWING CLAMP ASSEMBLY
Be sure to visit us at A.S.T.E. Show Booth 113
WRITE TODAY
For our 72 page illustrated catalog. Contains full size tracing templates of each product, bound in loose leaf form for easy removal. SAVE TOOL AND DESIGN COSTS.
MORTON MACHINE WORKS
2421 WOLCOTT ST. DETROIT 20, MICH.

CIRCLE INFORM-A-GRAM KEY No. 103

. . . Fabricating, from page 75

and pressure employed are from 25 to 50 percent higher (4) than those used for the uncoated base metal of equivalent gage thickness. In addition, the time period for spot welding is relatively shorter, varying from 2 to 8 cycles for 60 cycle A.C. Spot welds in zinc coated stock are satisfactory in every respect except that in the heavier gages ranging from 0.078 inches and over it is very difficult to prevent partial destruction of the zinc coating in that area immediately surrounding the tip. Close control of the variables mentioned along with sufficient machine capacity, both electrical and mechanical, will minimize this effect. Spot welding values are given in Table 2.

Table 2 Spot Welding Conditionsfor Zinc Coated Steels.

	Material Type			
	Armco Paint Grip	U.S.S. Paint Bond	U.S.S. Tight Coat	Granite City Process No. 44
Material thickness, inches	0.052	0.034	0.035	0.052
Type of Electrode*	1½" radius	1½" radius	1½" radius	1½" radius
Welding force, lbs.	580	480	480	570
Current timing, cycles	8	6	6	8
Welding current, amperes	9500	8260	9100	9680
Breaking load, lbs./spot	1000	870	703	15115
Where flat faced electrodes are used:—				
Tip face diameter, inches	1/4	3/16	3/16	1/4
Tip pressure, lbs.	780	390	390	780

*Electrode Material—Elkaloy A or Mallory 3 Metal

The importance of water cooling of the electrodes cannot be over-emphasized. If this is not done, there is danger that the molten coating will alloy with the electrode material thus causing difficulty. It is also recognized that "pick-up" is an inherent difficulty; this necessitating a frequent cleaning of the electrode face with a fine emery cloth. This practice will assure better electrical contact and the production of a strong, clean weld. A recommended electrode material (8) for resistance welding these coated materials is Elkaloy A, which has little tendency toward intercrystalline penetration. This electrode type has high electrical and thermal conductivity and, with efficient water cooling, will give excellent service. In the welding of the heavier gages, where high electrode pressures are required, an electrode material such as Mallory 3 Metal is recommended.

Where seam welding is contemplated, the procedures employed are similar to those used for mild steel, however, as in spot welding, both pressures and current values are higher. In addition, slower speeds are required. Greater difficulties in seam welding than those experienced in spot welding should be anticipated. This is primarily due to the low melting point of the coating and the resultant alloying of this coating to the face of the electrode wheel. Thus, higher maintenance can be expected. In many instances, with

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the use of a proper knurl drive, the coating may be broken sufficiently to attain a sound weld with minimum pick-up. Needless to state, water cooling of both work and electrode is required. When required, zinc coated steels can be projection welded; the projection design and procedures being very similar to those used for mild steel.

Zinc coated sheets can be soldered provided an effective fluxing agent is employed; a recommended fluxing agent ([3]) being composed of equal parts of cut acid, raw acid, denatured alcohol and water. The acid that is normally used is muriatic; the "cut acid" being obtained by dissolving zinc in the raw acid until there is no activity. In the event of a joint which requires impact strength, a 60 percent tin, 40 percent lead solder is used. However, under normal conditions, the 35 percent tin, 65 percent lead solder will work satisfactorily. A cored solder containing ammonium chloride may also be used with success. In any event, after soldering has been completed, the excess flux should be removed since it is highly corrosive and may damage the coating.

In a fusion welding process, where it is necessary to restore full corrosion resistance to the welded joint, a re-coating process can be employed. A requisite is that the weld area be cleaned thoroughly prior to re-coating; this being done by sand blasting, wire brushing, or by grinding. The procedures that may be used are:

(a) by the application of a solder. A high lead, low tin solder is used on one side, while a lower melting point solder is employed on the other. Wiping the solder with burlap will aid in distribution of solder along the seam. Removal of fluxing material after re-coating is completed is required.

(b) after suitable fluxing and rinsing, the surface may be sprayed utilizing either a powdered zinc gun or a metallizing spray gun.

(c) by the use of an aluminum paint which can either be sprayed or painted on the weld joint. As this does not produce a true metallic coating, protection is not as good as the two previous methods mentioned.

(d) by the use of a special fluxed zinc powder which is either sprinkled on the weld or mixed with water to a consistency of a thick paste. The joint is carefully heated from either side until the zinc powder melts; the molten material being distributed evenly along the weld joint by wiping.

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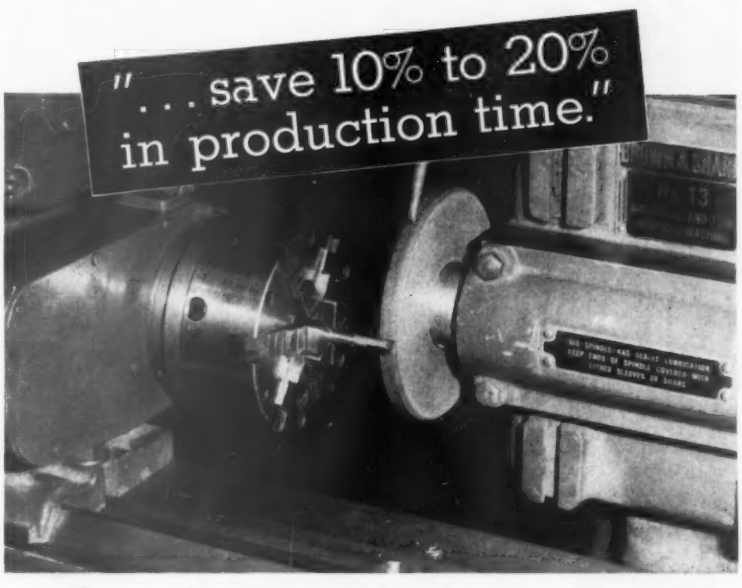

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. . . Hardness Testing, from page 84

may employ either one or the other, or even a combination of both functional relations, depending upon circumstances. This is a highly valuable feature.

Operates From 60-Cycle Current

The machine may be operated from any well-regulated 60-cycle current supply, and consumes about 100 volt-amperes. The magnetic hardness tester is essentially a 60-cycle impedance bridge, of which two arms are made up of combinations of resistors and capacitors, while the other two arms are windings, mounted on a laminated steel structure. The specimen to be tested is placed within the field of one of these windings. This changes both the inductance and the effective resistance of that winding, in accordance with the permeability and the resistivity of the specimen. The field of the second winding remains undisturbed.

The impedance bridge may be balanced by adjusting two sets of dials. One set of dials is capable of balancing the in-phase (resistive) component. The other row of dials is capable of balancing the bridge for the quadrature (inductive) component. The indicator employed is a short-period reflecting galvanometer of the iron-core dynamometer type.

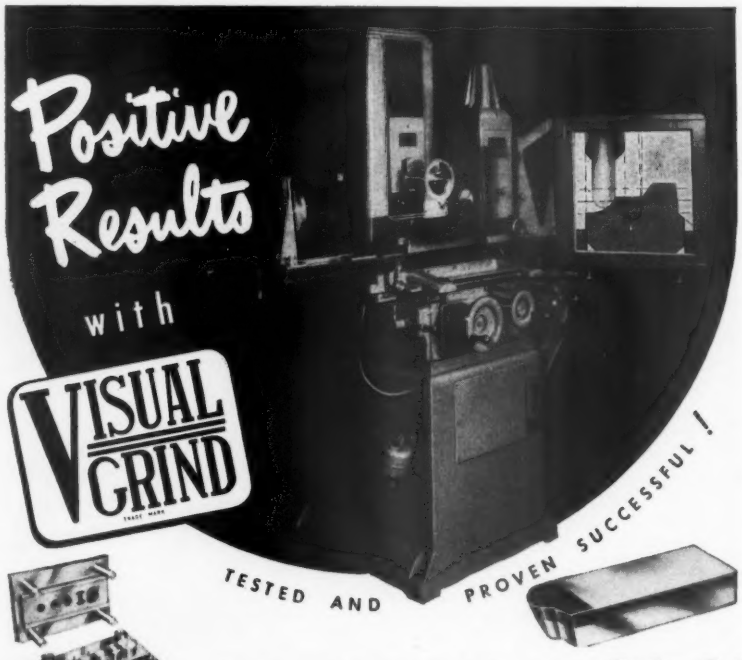
Three parts are required to make up the magnetic hardness tester. One of these is a sturdy oak cabinet, within which are mounted the various bridge elements, including the control panel and a galvanometer. In addition to controls already mentioned, facilities are provided for adjusting the bridge current, also for adjusting galvanometer sensitivity, and means for adjusting the phase of the out-of-balance current. The second part of the magnetic tester is an electromagnet, which carries the windings before mentioned, also an exciter winding. This electromagnet is arranged to receive attachments of various designs, which will accommodate specimens of various sizes and shapes, as required.

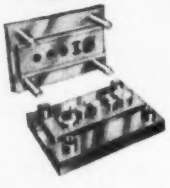
The third part of the tester is a foot-operated switch generally used. However, in some installations, a wrist-pressure-operated switch is used instead. This type of switch is claimed to increase testing speed, especially in the case of small items.

Method of Setting for Operation

To illustrate, assume that it is necessary to test a lot of specimens, all of the same shape and size, and all made from material of the same composition. Let it be assumed further that a hardness of 60, plus or minus 2, on the Rockwell C scale, is specified. Using a Rockwell instrument (or some other primary tester) select from the lot of pieces to be tested three specimens, having hardness values of 60, 58, and 62, respectively. The specimen representing a hardness of 60 (which is the ideal hardness) is placed on the electromagnet.

The foot switch is then closed, and the bridge is adjusted for complete balance. That is, it is adjusted for both the inductive and the resistive components. Complete balance is achieved by watching a spot of light which appears on a scale above. The scale mentioned is graduated





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from a zero point in the center to 20 in both directions, from right and left of center. Complete balance is indicated when the circular spot of light does not move upon closing the foot switch, and remains centered on zero when the toggle switch located on the control panel is opened or closed.

Now, replace the standard specimen with the softer specimen, representing a hardness degree of 58 Rockwell C, and again close the foot switch. The spot of light will now move to the left on the scale. The extent of this movement will depend upon the sensitivity and phase adjustment, which are under control of the operator. The extent of the deflection of the spot of light also depends upon the position of the toggle switch on the panel, since the position of that switch determines which of the two characteristics of the specimen (permeability or resistivity) is being employed.

Having adjusted the impedance bridge for optimum performance for the particular type of specimen, the low limit may be marked on the scale. Then, the high limit is determined by replacing the soft specimen with the hard one, and marking the upper limit on the scale. There is a door which covers the panel. This door should now be closed to prevent any tampering with the controls. Specimens to be tested are now placed (one by one) upon the electromagnet, and the switch closed. If the spot of light falls within the limits previously marked on the scale, hardness meets the plus or minus specifications. Otherwise, the piece involved must be rejected.

Microhardness Testing

More recent in the field of hardness checking is so-called microhardness testing. This term may be misleading to those unacquainted with the practice, because it has no reference to small hardness values, but means utilization of minute indentations, small enough to permit hardness determinations in very small areas and on very thin or small materials. Microhardness implies testing hardness of small or thin specimens, such as thin foils and wire, at small loads below 100 grams. It would be better to speak of micro-indentation hardness testing, or microscopic indentation hardness testing, but the term microhardness testing has come into general use.

So-called microhardness testing permits exploration of hardness over relative surfaces, very near to delicate cutting edges of tools. Thin and superficially-hardened surfaces, or decarburized surfaces, may be tested to advantage by this method, in addition to thin-plated surfaces, thin sheet metal, very small precision parts, etc. While chiefly used on metals, it is also employed in non-metallic testing, as on enamels, glass, ceramics, plastics and even jewels.

Some machines, making use of the so-called Knoop indenter, permit hardness determinations of extremely thin metal, plated surfaces, etc. On these, the load applied may be as low as ten grams, or anywhere from that up to 3600 grams. However, tests made with loads under 25 grams (and in some cases loads from 25 to 100 grams) are only of com-

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parative value. Light-load testing of this type, with the very minute indentations obtained, requires use of highly-accurate and sensitive testing equipment. The machine used must be designed to apply light loads accurately, and the human element should be reduced to a minimum if accurate results are expected.

At least one machine is available which will do both micro and macro hardness testing. So-called macro testing refers to tests performed with the 136-degree diamond pyramid indenter, commonly referred to as the Vickers type. The machine particularly in mind will apply loads anywhere in the range from 10 grams to 50,000 grams. The Knoop indenter is used for tests from ten grams to 3600 grams, if so desired. The 136-degree diamond pyramid indenter may be used for tests over the entire range from ten grams to 50,000 grams.

Loads up to 10,000 grams are furnished as standard equipment with this machine, while loads from 10 kilograms to 50 kilograms are provided as an accessory. Steps of 100 grams are provided up to 1,000 grams. Steps of 1,000 grams are then provided from 1,000 to 5,000 grams. Steps of 5,000 grams are then available from 5,000 to 30,000 grams, and steps of 10,000 grams from 30,000 to 50,000 grams. For light loads, either 10, 25, 50 or 100 grams may be applied. The applied load is clearly shown on an indicator for loads over 1,000 grams. Loads in the range from 1,000 to 50,000 grams are applied and removed automatically.

Testers suitable for microhardness testing only are available in different load ranges. One microhardness tester will apply loads from 10 to 3600 grams, and may be used with either the Knoop or 136-degree diamond pyramid indenter. This machine is fully automatic. Application, period of application, and removal of a selected load are accomplished by electrically-operated mechanical controls in a synchronous cycle, eliminating manipulation of these variables by the operator, and allowing exact standardization of these factors.

Another very simple and more economical microhardness tester is mechanically operated, and will apply loads through the range from one to 1,000 grams. This type of machine has the load applied under dashpot control, is made both in bench and floor models, and may be used with either the Knoop or 136-degree diamond pyramid indenter. When making tests with very light loads, surfaces must be lapped perfectly flat and free from scratches and pits, in order to attain proper accuracy of measurement. The smaller the indentation to be employed, the better must be the surface finish.

When using the 136-degree indenter with relatively heavy loads, only polished or ground surfaces are required. There are cases where depth of indentations may be only one or two microns. Such small impressions are tremendously affected by errors in measuring indentation length. Thus, testing with loads under 25 grams should be resorted to only in cases where absolutely necessary. Such tests

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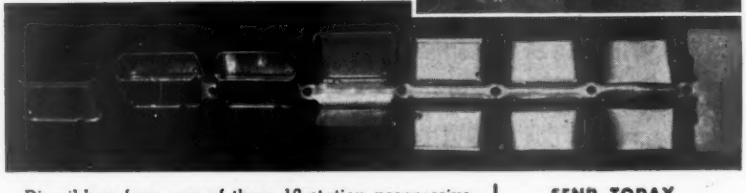

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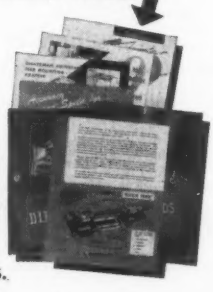

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should be employed for qualitative purposes, and never for specifications.

Knoop Indenter for Small Loads

A Knoop indenter should be used preferably where very small loads are applied. It is a diamond in material and is ground to a pyramidal form. It produces a diamond-shape indentation, having long and short diagonals of approximately the ratio of seven to one. This provides a longer measuring diagonal, and consequently permits hardness determinations in extremely thin metal, plated surfaces, etc.

One definite advantage is that the long diagonal is very little affected by elastic recovery when the load is removed. The depth of indentation is approximately 1/30th of the length of the long diagonal of the impression. A suitable microscope is provided with such testing machines, which allows length of the long diagonal to be very closely measured.

For making indentations in selected small areas, a specially-designed mechanical stage is available, and is recommended for holding the work. An area of a few thousandths of a square millimeter can be accurately located under the microscope when using this device. The specimen can then be moved under the indenter, the indentation made on a selected location, and the specimen returned under the microscope for reading dimensions of the impression. The impression is located to within better than ten microns of the desired area. The specimens move back and forth, between microscope and indenter, without any necessity for moving the mechanical stage from the elevating screw of the tester.

Slides and screws used in this tester are pre-loaded, to eliminate all lost motion. It is possible to make a row of indentations at any interval greater than 10 microns between indentations, by means of a mechanical screw calibrated so that one division of the wheel equals approximately 10 microns. A second micrometer screw is incorporated, and provides means for making a series of tests in a direction 90 degrees from the first series. Additional accessories, including a turntable vise and a thin metal clamp, as well as a V testing cradle, are available for use in connection with the mechanical stage mentioned, if desired.

Testing Individual Metal Crystals

When hardness tests are conducted by Brinell, Vickers or Rockwell methods, indentations made affect a large number of crystals in the metal, so that where alloys are being tested, the particular distribution, magnitude, and number of crystals engaged by the indenter inevitably influence results. Over against this, certain microhardness testers are unique in their ability to measure hardness of micro-constituents of alloys. That is to say, the hardness of any one crystal selected under the microscope may be determined, using a special micrometer eyepiece scale.

Instructions for this type of testing are available from those who manufacture such units. A diamond penetrator is employed, which is accurately ground to a

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square pyramid shape, the point of the diamond being ground to 136 degrees included angle between opposite facets. After an indentation is made with this type of penetrator, the diagonals of the indentation can be measured by using a microscope having a Filar micrometer eyepiece.

This eyepiece is one in which the eye and field lenses are of the same focal length. Within the eyepiece, two hairlines and an engraved micrometer scale are superimposed on the focused image of the specimen surface. The eye lens of the eyepiece is adjustable. This permits the hairlines and the micrometer scale to be precisely focused. One hairline is fixed across the center of the field. Thus, it serves as a guide in precisely placing the specimen in regard to the other hairline. The other hairline is movable. Its movement is effected by rotating a micrometer screw on the eyepiece mount.

This micrometer screw is provided with an adjustable drum head. The head is divided into 100 equal parts, and each division is equal to .01 mm sidewise movement of the hairline. It is very easy to estimate a tenth part of the division. This allows approximate measurements to .001 mm. When using such an eyepiece, one should practice moving the hairline in one direction only, while taking measurements. This practice will eliminate errors of measurement which might otherwise occur, owing to any possible backlash in the screw.

Unit Provides Scratch Tests

One highly interesting microhardness tester may be used for both indentation and scratch testing. Using this instrument, hardness tests may be conducted on a wide range of materials, including thin foils, fine wires, diffusion layers, constituents in a microstructure, and very small specimens. The apparatus renders possible research which affords increased understanding of the complicated problem of hardness. In a scratch test, the cutting instrument, which is usually a diamond point, is drawn with constant pressure against the surface of the specimen. The instrument in mind is one which may be employed for making scratch tests while employing exceedingly small loads, of the order of .5 to five grams.

It is sometimes necessary to determine quality of a material from a very small sample. In such instances, an instrument of this kind may be utilized to high advantage. Instances in point are determination of hardness of the working surface of small dental drills, thin twist drills, metal fragments, file teeth, etc. Hardness of microscopic components and alloys may be readily tested. The instrument is designed for use with inverted microscopes, and permits tests by static indentation with loads from .5 to 500 grams, and scratch tests with loads as light as .25 gram. Both types of tests may be made with the same diamond indenter, and in the same setup.

One very interesting microhardness tester designed for measuring both Knoop and Vickers indentations by means of a microscope provided with Filar eyepiece, has an indenter which is advanced downward into the specimen by means of a dashpot-controlled beam. An interesting

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aspect of this unit is that the beam is supported by a set of vertical flexure plates. These plates are sensitive, and provide high accuracy in adjusting for stable position of the beam before loading. Arrangement of this beam mounting is such that nothing can interfere or provide a drag on its action in such manner as to introduce variations to the load.

Width of Diamond Cut Measured

A very interesting instrument employed for making hardness measurements of small microscopic areas in metals, as well as in plating, foils, plastics, etc., has as its operating principle the making of a cut in material being measured with a very accurately-ground diamond point, which point is under a definite pressure. A case in point of hardness measurement with this device is testing of electrolytically-deposited chrome plate. Another is hardness testing of case-hardened steel.

Using a micrometer feed, a highly-polished and lubricated surface of the material to be tested is moved beneath the accurately-ground diamond point mentioned. After a cut has been made, width of the cut is measured under the microscope, and hardness is determined from a convenient formula. In designing this instrument, much study was devoted to the shape and proportion of a suitable cutting point. The corner of a cube was finally adopted as the most desirable shape. Such a point can be duplicated precisely, and is extremely durable.

It is necessary that the cutting point be elastically held, in order for it to respond to different depths of micro-cut. It is also necessary that movement should be very slow and uniform, so that no additional penetration is effected by slowing or stopping. The diamond point is attached to a spring in such manner that if the solid right angle or cutting point is considered as constituting one corner of an imaginary cube, the diagonal of this cube would then be normal to the test surface.

Hardness Tests on Plating

Use of microhardness testers of different types has been found advantageous in making studies of effects of various operating conditions on hardness of electrolytically-deposited metals. Obviously, such tests must be conducted by introducing only one variable at a time in plating practice.

Thus, studies can be made on varying hardnesses obtained in different plating runs where the only variable introduced is that of plating time. Subsequent studies can be made where the only variable allowed or introduced is that of current density. Again, separate studies can be made of hardness variations obtained where the only variable introduced in plating procedure is temperature of the bath. It is obvious that when close studies are made along these lines, plating schedules and setups militating toward ideal hardness specifications may be discovered and adopted.

In a few instances, it is believed, hot hardness tests have been made on plated finishes. Such are known to have been conducted by the National Bureau of Standards, and it is very

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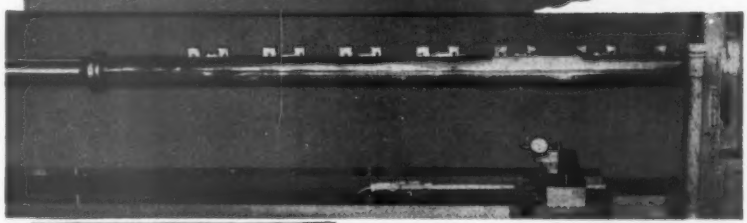

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probable that they have been conducted elsewhere. The fact is that checks on the hardness of hot materials may always be considered advantageous in cases where those materials are employed under heated conditions. In such tests, everything possible must be done to protect or shield the indenter employed against damage or rapid deterioration from the heat encountered in making the test. The indenter should be left in contact with the hot material only as long as absolutely necessary.

Multiple Angle Hardness Tester

A metal hardness tester known as the Penetrascope has been developed to meet the requirements for a hardness tester which is accurate as well as versatile. Operating on the Vickers principle, accuracy is obtained through the use of a 136° pyrimidal diamond indenter and a built-in microscope to measure the diagonals of the indentation within an accuracy of 0.001 mm.

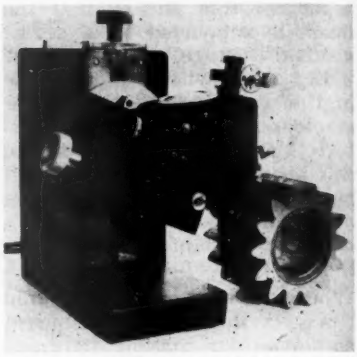

Photo courtesy C. Tennant, Sons & Co. of New York

Fig. 4. The semi-portable Multiple Angle Hardness Tester is very versatile in its application. Because it has no clamp in front of the indenter, it can be adjusted to operate at any angle. The base contains electro-magnets to hold the unit firmly to a ferrous base.

The basic instrument is portable and includes a 2″ C-clamp for small work. Standard alternative C-clamps, a chain clamp, and electro-magnetic clamp are available for testing conventional and relatively conventional shapes regardless of maximum size, whether in place, in the shop or in the laboratory.

The semiportable Multiple Angle Hardness Tester illustrated is the most versatile of the line as it has no clamp in front of the indenter and can be adjusted to operate at any angle. This unit consists of a Penetrascope movably mounted on a slotted stand the base of which contains electro-magnets to hold the unit firmly to a ferrous base during tests. The absence of clamps in front of the indenter and the ability to set the instrument at any angle enable the unit to test many places normally considered inaccessible to other accurate hardness testing instruments. Conventional bench testing may be carried out with this unit by setting the mounted Penetrascope in the vertical position and using the top of the base of the stand as an anvil.

Extremely accurate readings are obtained in the range 16 to 800/1000 D.P.H. (from softer than 0 Rockwell B to 64/69 Rockwell C), with excellent comparative readings obtainable up to about 1500 D.P.H. (75 Rockwell C). The 136° pyrimidal diamond indenter is used to test the entire range from tin to tungsten carbide (except for large grained metals).

Sid Tool Company

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SIZE	THREAD
4	32-48-60-64
5	30-32-36-48-60
6	36-40-48-56-60
7	32-40
8	24-30-36-38-40-44-48
9	24-28-32-40
10	28-30-36-40-48-64
12	20-28-32-36
14	20-24-28
1/16	60-64
5/64	72
3/32	48
7/64	48-56
1/8	32-40
5/32	32-36-40
9/64	36-40
11/64	36
3/16	20-24-32
13/64	32
7/32	24-28-32
1/4	18-24-26-27-30-32-36-40
5/16	16-20-22-27-28-32-40
3/8	12-16-18-20-27-28-32-36-40-48
7/16	12-16-18-22-24-27-28-30-32-36-40
1/2	12-14-16-18-22-24-26-27-28-30-32-40
9/16	16-20-24-27-28-30-32-40-48
5/8	12-14-16-20-24-27-28-32-36-40
11/16	11-16-18-20-24-27-28-30-32
3/4	9-11-12-14-18-20-24-26-27-28-32
13/16	10-14-18-20-32
7/8	10-12-16-18-20-24-27-28-32
15/16	8-9-10-12-14-16-18-20-24-32
1	10-12-16-18-20-24-27-32-40
1-1/16	12-14-16-18-20-24
1-1/8	8-10-14-16-18-20-24-32
1-3/16	8-10-12-14-16-18-20-24
1-1/4	8-10-14-16-18-20-24-32
1-5/16	12-14-16-18-20-24-32
1-3/8	8-10-14-16-18-20-24
1-7/16	8-10-12-16-18-20-24
1-1/2	8-10-14-16-18-20-24-28
1-9/16	18-20-24
1-5/8	5½-8-10-12-13-16-18-20-24
1-11/16	10-12-14-16-18-20-24
1-3/4	8-10-12-14-16-18-20-24
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20-24
1-15/16	8-10-12-14-16-18-20-24-28
2	4-1/2-8-10-12-16-18-20
2-1/16	12-14
2-1/8	12-16-20
2-3/16	12-16
2-1/4	4-½-8-12-14-16-18
2-5/16	12-18
2-3/8	12-16-18
2-1/2	8-10-12
2-9/16	18
2-5/8	12-16-20
2-3/4	16
2-7/8	8-12-16
3	8-16
3-1/4	8-12-16
3-1/2	8-12-16
3-7/8	6
4	8-12

HIGH SPEED LEFT HAND TAPS

SIZE	THREAD
0	80
1	56-64-72
2	56-64
3	56
4	32-36-40-48
5	40-44
6	32-36-40
8	32-36-40
10	24-30-32-40
12	24-28-32
1/4	20-28-32
5/16	18-20-24-28-32
3/8	16-24-32
7/16	14-20-28
1/2	12-13-20-28
9/16	12-18-20-24
5/8	11-12-18-20-24
11/16	11-16-24
3/4	10-16-18-20
13/16	16
7/8	9-12-14-18-20
1	8-12-14-16-18-20
1-1/8	7-12
1-1/4	7-12-16-18
1-3/8	6-8-10-12-16-18-20-24
1-7/16	8-10-12-14-16-18-20
1-1/2	6-8-10-12-16-18-20
1-9/16	8-10-12-16-18-20
1-5/8	8-10-12-14-16-18-20
1-11/16	8-10-12-14-16-18-20
1-3/4	8-10-12-14-16-18-20
1-13/16	8-10-12-14-16-18-20
1-7/8	8-10-12-14-16-18-20
1-15/16	8-10-12-14-16-18-20
2	4½-10-12

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CIRCLE INFORM-A-GRAM KEY No. 112

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—Compiled by Elmer H. Hahn, Jr., author of "Titanium . . . the Metal of 1954?", and W. N. Nordquist, Tech. Ed., TOOLING & PRODUCTION.

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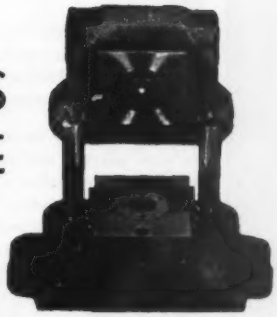

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CIRCLE INFORM-A-GRAM KEY No. 113

INDUSTRIAL NEWS

Wales-Strippit Corporation. Bill L. Gaines has been appointed sales engineer for the South Central Division of the Wales-Strippit Corporation, manufacturers of machine tools.

Having completed a two-month training course at North Tonawanda, New York, home office and main plant of the company, Mr. Gaines will operate out of the St. Louis division headquarters, handling most of Indiana, Illinois, Missouri and Kansas.

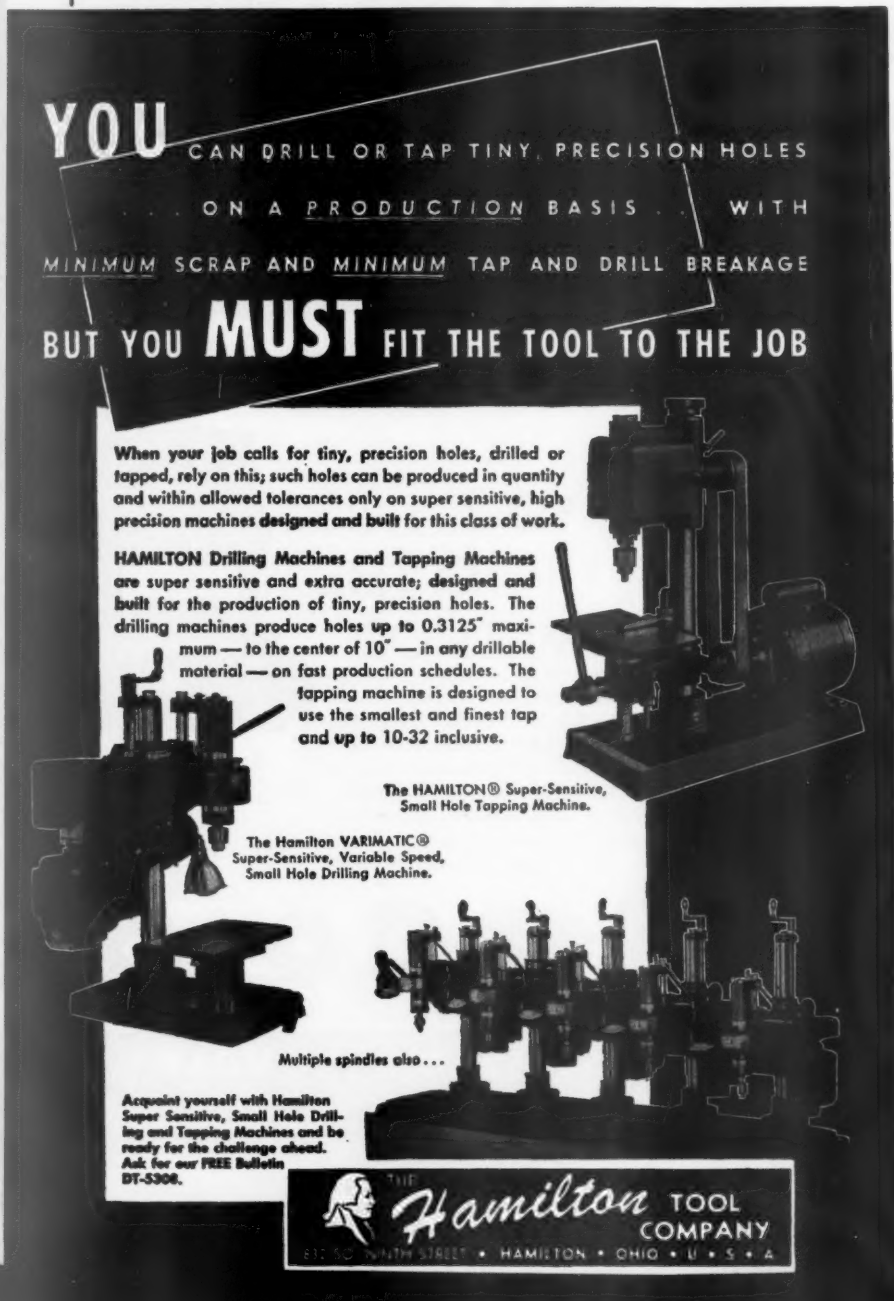
Prior to joining the Wales-Strippit Corporation, Mr. Gaines was employed as a tool engineer by International Harvester. He is current Chairman of the Editorial and Public Relations Committee of the American Society of Tool Engineers, Evansville chapter.

Firth Sterling Inc. T. G. Barnes, Vice President in Charge of Sales at Firth Sterling Inc., has announced that M. F. Judkins, Products Manager, will be in charge of the commercial sales of zirconium and zirconium alloys.

The company recently announced its entry into the production of zirconium ingots, billets, bars, rods, wire, sheet and tubing from zirconium sponge. The metal is presently being used as a structural material where nuclear fission is involved. Because of the probable future scarcity of fuels, it is contemplated that uranium will some day be utilized to generate electric power. However, as the government controls all fissionable material, legislation must be passed in order to release nuclear fuel for development by private enterprise of methods for generating electric power. In this event, zirconium will probably become a basic structural material in the power generating industry.

Immediate uses for zirconium are in the chemical, pharmaceutical and petroleum industries. More resistant to corrosion than any metal except tantalum, which is very expensive and scarce, zirconium is an excellent engineering material that can be fabricated into useful shapes by conventional methods, such as sheets, tubing, pressure vessels, etc. It can be melted, cast, forged, rolled, or extruded. It is nontoxic, and safe to handle at high temperatures. Equally important is the fact that it is the ninth most abundant metal in the Earth's crust.

Firth Sterling will utilize Kroll process sponge in producing the metal. As the material must be kept pure and free from contamination, latest type furnaces are being installed in the company's plant at Trafford, Pa. These furnaces will operate under inert atmosphere by the introduction of argon and helium gases. Actual production will be started sometime in January.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INDUSTRIAL NEWS

Mr. Judkins announces that J. Mahon Childs will be the project engineer for industrial sales of zirconium.

Carboloy Department of General Electric Company. Mahar Tool Supply Co. Inc., Saginaw, Michigan, has been named an authorized distributor for Carboloy Department of General Electric Company, Detroit.

The organization will carry the Department's entire line of standard cemented carbide tools and blanks, carbide-tipped masonry drills and diamond wheel dressers.

Sidney F. Kaufman, newly graduated from General Electric Company's chemical and metallurgical training program, joined the Carboloy Department of General Electric Company as an engineer in the carbide powder processing and fabrication development unit. He is a graduate metallurgical engineer from Carnegie Institute of Technology.

M. L. Smith has rejoined Carboloy Department of General Electric Company, Detroit, as a marketing trainee in the permanent magnet field, after two years in the Marine Corp.

Smith holds a B. S. in metallurgy from the University of Notre Dame. He joined the General Electric Company's chemical and metallurgical engineering training program in Feb., 1949, transferring to Carboloy Department in 1950. He was called into the Marine Corps in September, 1951.

Frank Brossy, formerly with MacManus, John & Adams, Inc., Bloomfield Hills, Mich., has joined the Advertising and Sales Promotion section of Carboloy Department of General Electric Company, Detroit.

Brossy received a B.B.A. in business administration from the University of Michigan in 1951. At his former post, he specialized in sales promotion copy writing.

Pennsylvania Salt Mfg. Co. W. J. Stoddard has been named District Supervisor in the Michigan District for the Metal Processing Department of Pennsylvania Salt Manufacturing Company, it was announced by J. J. Duffy, Jr., Sales Manager.

In this new position, Mr. Stoddard will supervise sales and service activities in the Michigan area for Pennsalt metal cleaners, Fosbond phosphate coating and Fos Process lubricants for cold working.

Mr. Stoddard, well-known in metal working circles in Detroit area, has a background of 23 years service with Pennsalt. Prior to joining the Metal Processing group as a sales-service engineer in 1941, he worked in the laboratory at Pennsalt's Wyandotte, Michigan, plant.

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CIRCLE INFORM-A-GRAM KEY No. 115

LONGER WHEEL LIFE OBTAINED WITH NEW GRINDING FLUID

Grinding is similar to machining in that the metal is removed in the form of small chips. The multiple cutting edges in a grinding wheel, in the form of abrasive particles of grit are sharpened either by the grits fracturing or else by being released from the bonding material during the grinding operation.

According to investigators associated with the Master Chemical Corporation, if the wheel and the coolant are not properly "matched" for the operation, the wheel will not break down properly. This results in a glazed wheel or loaded wheel, which, in turn, produces a slow grinding rate, chatter, loss of dimensional accuracy, and excessive heat generation. It is then that external means must be used to resharpen the wheel by "dressing" with a diamond or other device.

If the combination of wheel, coolant, work material, feed and relative wheel-workpiece speeds are correct, wheel dressing is kept at a minimum. Actually, it is far more economical to have high rates of production, and to allow the wheel to break down properly, than to have lower production rates and to resort continually to wheel conditioning or dressing. In general, most concerns use wheels too hard in cutting fluid too lean, in the false belief that they are being economical. Wheels are lost more by dressing, than by proper wheel wear.

For the same amount of metal removal in unit time, approximately 10 times as much power is required for grinding as for turning. The coefficient of friction for grinding is about three times that for turning. Consequently, for long wheel life and high surface finish, it appears to Master Chemical researchers that lubricity or anti-weld in the grinding fluid is generally more important than its cooling properties. One reason cited for this is that while the rake angles of cutting tools are pre-determined and set, those in a grinding wheel are at random and cannot be controlled.

Theoretically, the rake angles of grit in a grinding wheel vary from 90° positive, through 0° to 90° negative. It is well known that in going from a positive rake angle to a negative rake angle, power requirements increase. In grinding, the rubbing of the grit surface also increases friction and heat similar to the rubbing of the flank on a cutting tool. This leads to the theory that the lubricity of a grinding fluid is very important for good finish and long wheel life.

It is known that grinding oils promote the best finishes and the longest wheel life. The "toughest" grinding jobs, such as thread grinding and crush wheel form grinding, are done with grinding oils. However, such oils allow

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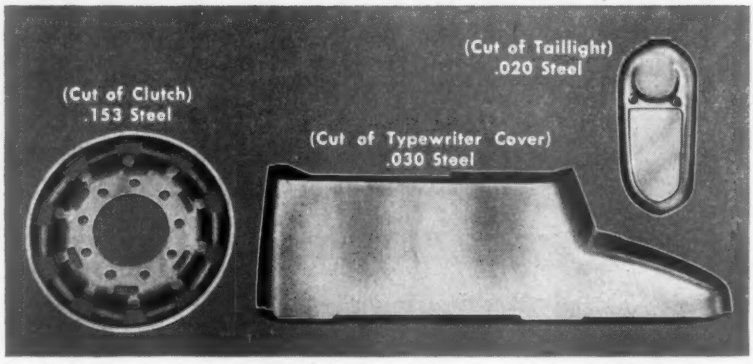

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CIRCLE INFORM-A-GRAM KEY No. 116

the workpiece to heat up, don't settle chips readily, and are "messy" to use. To eliminate these disadvantages, chemists associated with Master Chemical have come up with a new type fluid, which will be known as Trim.

If conventional grinding oil is being used (for example, in gear grinding or form grinding) and it is desirable to test the new fluid in comparison, frequently the same wheel can be used, using 1 part Trim in 20 to 40 parts of water. If burning of the work has been experienced with the grinding oil, it indicates that the wheel was too hard; the substitution of the new fluid will often eliminate burning.

Master Chemical researchers claim that conventional soluble oils generally produce grinding results inferior to the new fluid, either because these emulsions do not prevent wheel "loading" or because they allow the grit of the wheel to dull or "glaze" too rapidly. Solutions of the new fluid keep the wheel clean and "open", permitting fast grinding and, because of its high lubricity, improving the finish and increasing the number of pieces obtained by each dressing for the wheel. Because of the rapid wetting, small particle size, and high lubricity of the new fluid, the chips pass over the grit of the wheel easily, reducing the pressure and the heat generation. Thus, work can be held to closer tolerances for longer periods between wheel dressings.

When replacing soluble oils for grinding, the new fluid is used 1 part in 20 to 50 parts water. It is best to start with the more dilute solutions. In general, as in machining, more Trim will improve the finish of the ductile materials, while more water may be required for reducing the heat when grinding hard or less ductile materials.

When surface grinding, using large wheel surfaces, such wheels are usually of softer grade than those used for grinding with the periphery of the wheel. For such grinding, solutions are generally used more dilute in order to promote proper wheel breakdown.

Rich solutions retard wheel breakdown, because of high lubricity, so that softer wheels actually will produce more pieces per wheel dressing and for the total wheel life than will a harder wheel and leaner solution. It is also frequently possible to use wheels of larger grit size, still obtaining very fine finishes and at higher production rates. Further improvement of finish can be obtained by using wheels of finer grit size. Using richer solutions reduces strain on spindles and workpiece, resulting in longer spindle life and more accurate grinding.

When centerless grinding, the lubricating quality of the grinding fluid is important because of relative life of the work rest bar.

Solutions of the new fluid permit extremely rapid settling of the larger steel chips, whereas the finer chips float. Consequently, the coolant withdrawn from the sump by the pump for return to the work is quite clean. This is important because chips are approximately two to four times as hard as the metal being ground and it is necessary to prevent their recirculation to the work, to prevent scoring.

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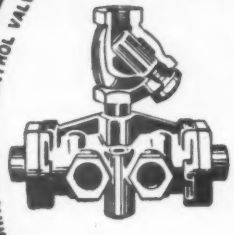

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CIRCLE INFORM-A-GRAM KEY No. 117

. . . Pressure Gage, from page 93

follows: Firstly, a Dillon mechanical pressure gage is placed on a scissors-type jack to which a hand wheel has been attached. A hydraulic jack is also used at times. The spring to be tested is placed on a movable platform, or spring washer, which is part of a telescoping bar. Turning the hand wheel raises the jack, and force is applied through the gauge to the telescoping bar, thus compresses the spring upwardly against the underside of a fixed platform. A fixed scale adjacent to the moving bar permits measurement of deflection. By this means, an accurate reading of load and deflection characteristics of the spring is quickly obtained.

According to Mr. C. G. Weber, Chief Engineer of Farris Engineering, not only is this arrangement simple to construct from available shop materials, but a considerable saving is achieved over other test methods as the cost of the pressure gage is much less that that of regular spring testing machines. The device is quickly adapted to test various sizes of springs.

Although the pressure gage illustrated is a 0-2500 lb. capacity unit, 8 other capacities are also available ranging from 0-10 lbs.

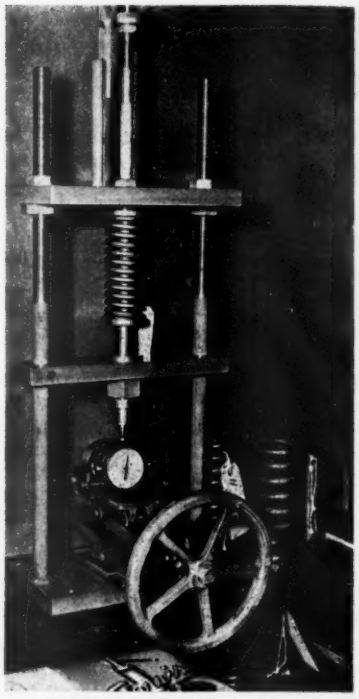

Photo courtesy W. C. Dillon & Company, Inc.

up to 0-5000 lbs. Approximate net weight of each is 2½ lbs., and dimensions are 4¾ x 2⅛ x 3⅛". Accuracy is guaranteed to 1%± indicated reading. Maximum indicator is optional.

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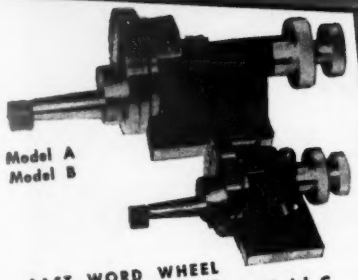
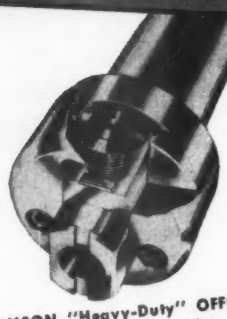


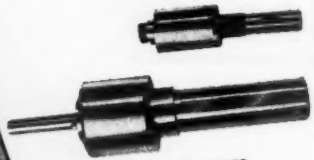
Model A
Model B

LAST WORD WHEEL DRESSERS FOR RADIUS AND TANGENT ANGLE DRESSING — AVAILABLE IN 3 MODELS. MODEL A—For grinders using wheels up to 20" dia. MODEL B—For small model surface grinders with 7" max. wheel dia. MODEL C—Compound Dresser, will compensate for compound angles involved in grinding form tools.

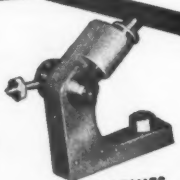
Model C



SAMSON "Heavy-Duty" OFFSET BORING CHUCK—Has positive centering feature for drilling and milling operations. Complete accessories available.



GRAY-GRIMES FLOATING DRIVER—For reaming, tapping, valve seating and similar operations. Can be supplied with standard or special shanks and adaptors.



GRAY-GRIMES AUTOMATIC STEADY-REST FOR O.D. GRINDING—Permits grinding complete length of shaft maintaining constant pressure against workpiece as stock is removed.

Mfg'd by Gray-Grimes Tool Co.

Send for complete data

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CIRCLE INFORM-A-GRAM KEY No. 118

A Sound Solution to Industrial Noise Problems

New Device Designed to Combat Excessive Noise at Low Cost.

An entirely new approach to the problem of industrial noise by use of economical, small, portable, light weight and easily installed sound absorbing units was recently announced by the manufacturer.

Known as Sonosorbers, the units have inner cores encased in perforated embossed aluminum and are light weight (about 2½ pounds each) and are easy to clean. They are especially suited for noisy industrial and commercial locations where ordinary

. . . Continued on page 165

Carbide Insert Provides A Tool Cost of 3/8¢ Per Piece

Greatly extended tool life was recently obtained at the Capitol Machine Co., Columbus, Ohio, a modern contract machine shop, by use of clamped tungsten carbide tooling for boring alloy iron (Brinell 210-230) truck brake drums.

Machining the 16.420" bore to a 7" depth on a Potter and Johnston turret lathe proved too tough for conventional brazed carbide tools first tried on this operation. Because of excessive heat developed during the cut — which varies from 1/8" to 1/4" depth due to run-out of the casting — only about 5 pieces could be bored per grind.

Now, with a Kennamatic tungsten carbide vertically clamped square insert tool, 20 to 25 drums are readily bored per indexable cutting edge. This represents about 6 miles of lineal cutting. Both the insert's back and side rake angles were changed to zero by grinding across its corners with the holder in a grinder vise. Operation is handled at 0.024-inch feed per revolution and 240 surface feet per minute.

Since four new edges are available on each end of the insert, 160 to 200 pieces are bored per grind. Approximately 20 regrinds are available per tool for a total of 3200 to 4000 drums per insert life.

To determine tool cost per piece, the holder, which costs $20.00, is prorated over the life of six inserts. Since an insert costs $7.89, the prorated total cost is $11.22. On this basis, tool cost per piece is only $0.003 or 3/8 of a cent.

In addition to providing this low boring cost, the clamped carbide tooling materially increased production by minimizing tool-changing down time.

Photo courtesy Kennametal, Inc.

The G. S. Equipment Company, 5317 St. Clair Avenue, Cleveland, Ohio, a new corporation, has been organized to serve the metalfinishing industry with new equipment of its own design and manufacture as well as other national makes, according to T. R. Gill, Vice President and General Manager.

It was organized by the officers and directors of The General Supply Company, same address, and will take over all equipment sales formerly handled by that firm. The General Supply Company continues to serve the metal finishing industry with supplies only.

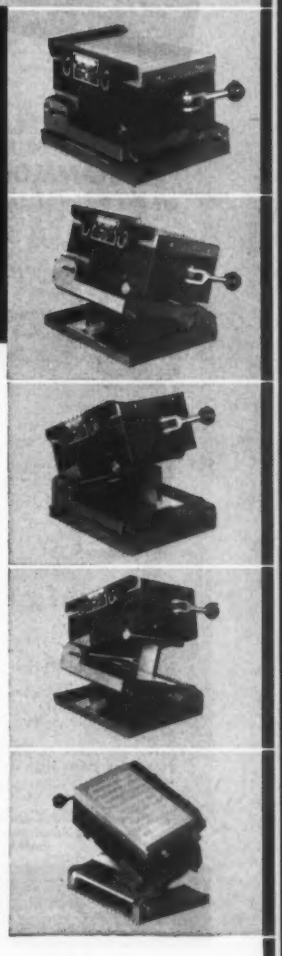
The new corporation is reported to be developing many new units of equipment, one of which is said to be a plating barrel of revolutionary design slated for an early introduction.

Cleveland Crane & Engineering Co. A new direct factory office was opened late last year in Detroit by The Cleveland Crane & Engineering Co., Wickliffe, Ohio, for the sale and service of Steelweld metalforming presses and shears throughout the State of Michigan.

Located at 2361 Penobcost Building, the offices will be headed by Mr. Ralph K. Ford, who was with the Steelweld Machinery Division at the Home Office for several years.

Industry's most versatile Magnetic Chuck

MAGNA-SINE



Here is a magnetic chuck that not only handles your parallel work but angular work, too. And angular set-ups to gauge block accuracy take but a matter of minutes!

Any angle—single or compound—is set up by inserting gauge blocks between the Magna-Sine's precision hinged base plates. Correct blocks to use are indicated in Table of Constants provided. Hours of set-up time are saved, angular accuracy is positive, work is held distortion-free on permanent magnet chuck.

Thousands in use for grinding, inspection, drilling, boring.
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PRESCRIPTIONS FOR PRODUCTION

Carbide surface broaches, as told to us by Stan Florek of U. S. Carbide Tool, often justify the addition of "bumper sections" made of tool steel or cast alloy. These cut only when over-size pieces enter the machine, which would be destructive to first carbide teeth. The "bumper section" may eliminate the down-time that would be caused by a photo-electric system signalling the machine to stop when an over-size casting is encountered.

Contoured sheet metal, up to 14-gauge, may be cut safely by a so-called (and no wonder) "Little Wonder" nibbler. With a flexible punch-and-die arrangement that does not disturb the contours of surrounding metal, this unit may be used as a hand tool or vise-mounted for production work.

Manufacturers of metal stampings made in progressive dies from strip stock may experience the necessity of adding numerous new designs each week or each month. The lead time for such press tooling is normally quite long and may necessitate a substitute product. But, these various stampings may fall naturally into families, wherein the operations performed at individual stations can be largely standardized. If so, it is likely that station tooling, also, can be standardized. Over a period of time, an inventory of station tools and related die components can be developed. Then, when a part is received for production, the standard station tools can be quickly assembled in proper sequence to form the complete die to produce the finished item.

Continuously close tolerances on thickness of ultra-thin metal strip are being held at American Silver Co. with the aid of the (relatively) new Beta Ray Gauges. Copper strip of 0.0060" thickness is being rolled regularly to a tolerance of plus or minus 0.0001". American Silver is a well known custom-roller of precious, stainless, and other metals producing strip as thin as .0005".

Cleaning the chromed faces of dimple dies has long been a problem. In the presence of 600° dimpling heat, aluminum burrs, burned grease, and paint both fuse and cake—particularly around the base of the die cone. This ruins die configuration and causes marred or mis-shaped dimples. It is necessary to periodically remove the dies and clean them. This has customarily been done by grinding, but abrasives often did more harm than good. About one-fifth of the dies were lost. D. R. Gates at the TEMCO aircraft plant in Dallas decided the cleaning could better be done by bathing the dies in a cup-to-a-gallon mixture of caustic soda and water. This is heated to 200° F in a glass or steel container on a hot plate. Using an iron or steel basket, dirty dies are dipped for two to 10 minutes, rinsed in plain water, and dried. Care must be used in handling the caustic soda, but it won't hurt the chrome, iron, or steel die materials. Ten minutes work replaces eight hours.

The new Allen-Bradley electronic time relay was developed for primary use on machine tool and similar a-c applications where high accuracy in constant recycling over long periods is required. Ranges from .025 seconds to two minutes. Reset time is about 1/10 of the maximum time delay.

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FAST CARBIDE TOOL GRINDING

For Fast Grinding of Carbide and High Speed Tools,
HAMMOND 14" GRINDERS
are the Choice of America's Leading Manufacturers . . .

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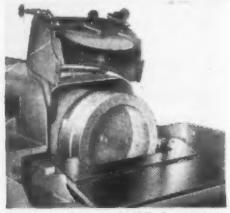
Wet or Dry

NO SPRAY—NO SPLASH (Patented) Swivel guard closes one side of wheel while other is in use, permitting freedom of movement and unobstructed vision.



EASY WHEEL CHANGE, by removing two cap screws and raising Wheel Hood on top, allowing easy access to wheel. Spout connections do not require disconnecting.

SAFETY CUP WHEEL DISC (Patented) closes cup of wheel, preventing hand injuries or dropping tools into cup of wheel.

Note these PLUS FEATURES . . .

- Two operators can grind tools with freedom of movement
- "No Spray—No Splash" guards (Patented)
- Safety cup wheel disc (Patented), prevents dropping tools into wheel cup
- Easy and quick wheel change
- Tables adjust "in and out" by hand crank to compensate for wheel wear
- Wet or dry—or CO_2 carbon dioxide
- Oversize, ball bearing, precision spindle with multi-V-belt drive
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CIRCLE INFORM-A-GRAM KEY No. 120

PRESCRIPTIONS FOR PRODUCTION

Burnished work surfaces, not work hardening, are frequent causes of localized poor machinability of stainless steels, according to George Stevens of Armco Steel Corporation and authority on screw machine work. Stevens claims that even momentary dwell of a tool may have an adverse burnishing effect. Some types of stainless are more susceptible than others. When this burnished surface is encountered on a succeeding cut, the tool rides up and will not start cutting. Such a condition, says Stevens, may be greatly alleviated by simply rubbing chalk on the too-smooth surface.

For maximum economy and versatility in short-run vacuum metallizing, Consolidated Vacuum Corp. has developed a new 30" vacuum coater that operates at 4 cycles per hour. Although it is equipped with two large-capacity rotating fixtures, the unit is very compact due to such innovations as utilizing the chamber door as a control panel.

The Ace Art Company recently reported that six sintered nylon bearings had withstood 18 months of continuous use (40 hrs/wk), replacing bronze bearings on the conveyor-belt roll feed and horizontal back shaft of a light production machine. The roll feed operates at 460 revs/min and the back shaft at 250 revs/min. No lubrication is used. The bearings made from "Nylasint" nylon molding powder showed no wear, while conventional bronze bearings installed at the same time on similar equipment showed considerable wear.

The recently introduced "U. S. Vertical" milling machine provides for angular setting of the head through 180°. Head guard lifts to simplify changing of belt position. Machine is designed throughout to economically provide greater rigidity, accuracy, and versatility than normally provided by a vertical attachment on a standard horizontal miller.

One night your Technical Editor was having a chit-chat with Phil Fishback of Thompson Products and Tom Thygeson of Yoder roll-form fame. I was diddling around with a pair of Carboloy's high strength sintered Alnico V permanent magnets. Twas not long before Tom's inventive powers came into play. His idea, gentlemen, is to use magnets embedded in plastic templates to eliminate clamping. Simple, but it might save you a few bucks and a lot of time.

Cellulose sponge sweatbands are popular with workers exposed to excessive heat. The important point is that they should be thoroughly moistened and then squeezed before wearing. Dry cellulose sponge is irritating to the skin and will absorb less perspiration.

Your millwrights may be able to effectively use a little device that's become popular with refrigerator servicemen. It's the Marsh soundscope by which you can listen in, locate, and identify abnormal machine sounds. A probe and amplifier-earpiece make up this device, which can eliminate a lot of guessing and save a lot of time.

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A NEW BABY AT
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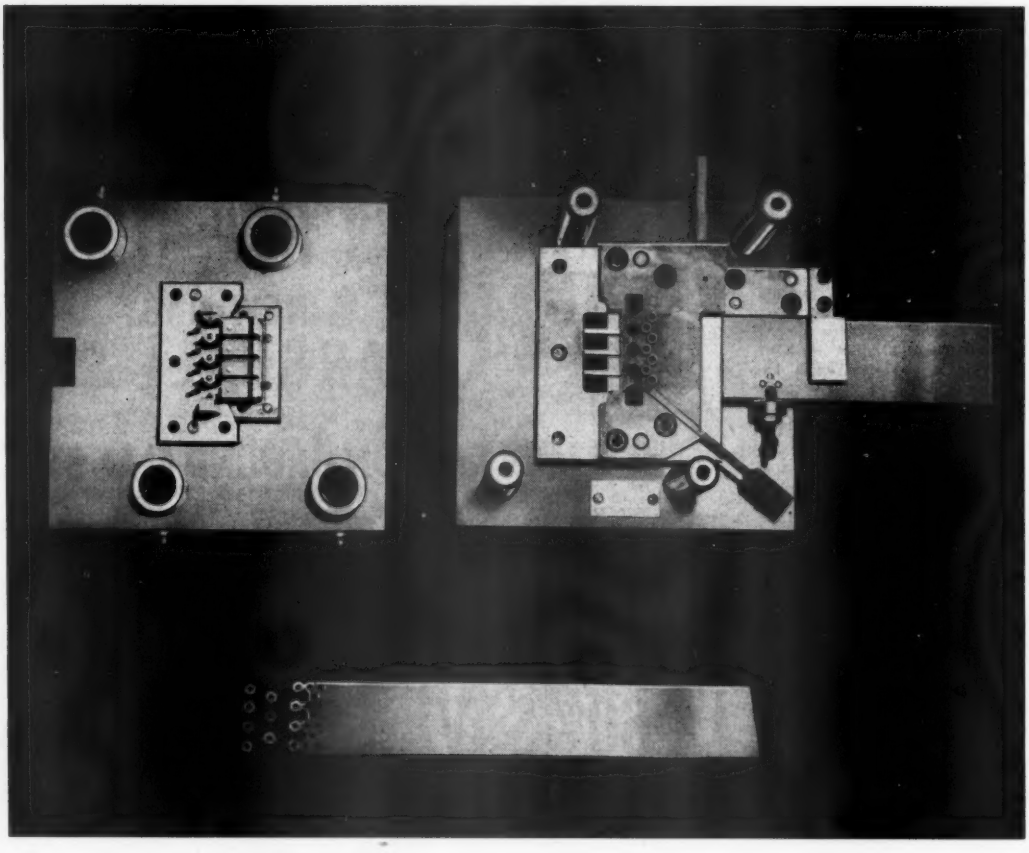
CIRCLE INFORM-A-GRAM KEY No. 121

CRACKING A TOUGH NUT!



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New TRU-GRIP Tap Holder is lighter, smaller in diameter. It affords easier tapping close to walls or shoulders.

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Or, better still, start looking for methods to improve product quality and reduce production costs. Like an Ohio foundry, where a test *proved* that a lighter, faster Buckeye portable grinder could do an even better job, in less time, at lower cost. And, as a "bonus," this grinder has been operating for more than two full years without any repair service required.

In every industry, it's time to improve your competitive position. If this involves portable air tools, it's time to test Buckeye Tools in your plant, on your work, to *prove* them to your own satisfaction. May we send you a copy of our Air Tools Catalog?

Getting into the corners is easy with this lightweight, maneuverable Buckeye horizontal grinder. Faster speed means less wear on cone wheels, too.

On jobs where large, relatively flat surfaces are worked, Buckeye vertical grinders help increase productive output, improve product quality.

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producers of the world's first successful rotary air tools

CIRCLE INFORM-A-GRAM KEY No. 124

"SETUP SLUGS" REDUCE SETUP TIME

The Fulton-Sylphon Division of the Robershaw-Fulton Controls Company in Knoxville, Tennessee, makes excellent use of "setup slugs" to reduce setup time on their Warner & Swasey multiple-spindle automatics which produce parts to close tolerances in lot sizes averaging 1000 pieces.

This well-known company manufactures over 3200 different models of temperature control valves for use in domestic, industrial, and armed forces applications. Consequently, jobs must be released in small lots in order to keep inventory down.

Photo courtesy Warner & Swasey Co.

The Fulton-Sylphon Division of the Robertshaw-Fulton Co. has reduced setup time on their Warner & Swasey multiple-spindle automatics by using setup slugs. Above are shown a few of the many different types of setup slugs they're using.

The multiple-spindle automatics produce the bellows components from corrosio-resistant material such as stainless steel, monel, aluminum bronze, and phosphor bronze — material which is difficut to machine. Material of this nature is extremely abrasive, necessitating frequent resharpening and replacement of cutters.

These factors made it impera-

tive that Fulton-Sylphon reduce their turning cost factors wherever possible. The speeds and feeds on hard-to-machine materials, such as they use, are pretty well fixed. The only opportunity, therefore, for a reduction in time and consequent cost was in the setup time of the machine.

This they accomplish by using the "setup slug". This setup slug is actually a completed part which has not been cut off from the stub end of bar stock. Examples of a few of the wide variety of different parts can be seen in the photograph. When a repeat job is to be run, the setup slug is inserted in one of the collets and indexed to each of the five positions. The cutters in each station are in turn set to an approximation of the finished part. After the machine is loaded with bar stock, finished size on the parts can be quickly obtained by the micrometer adjustments on the cross slides. Feeds are instantly obtained by setting the three feed dials and the stroke length can be quickly obtained by adjustments on the longitudinal and cross quadrant controls.

On a recent run of 2200 pieces, Fulton-Sylphon reports that the aluminum bronze parts were produced at the rate of 62 seconds per piece on the automatic. Previously their best turret lathe time was 5¼ minutes per piece. Thus an over-all production increase of 5 to 1 was realized on small lot production, in spite of the longer setup times required on multiple-spindle automatics as compared with turret lathes.

In addition, Fulton-Sylphon reports, tolerances were held within .003 total indicator reading and one particular diameter was finished to 8 micro-inches. Previously this diameter had to be finished on a bench lathe after the turret lathe operation.

This is just one example of the time savings Fulton-Sylphon has obtained by combining the "setup slug" technique with their "quick to setup" Warner & Swasey multiple-spindle automatics. Their overall records indicate that the setup slug method has enabled them to reduce setup time an average of 40% on a wide variety of threaded parts. On parts which are not threaded, they claim the setup time can be reduced as much as 50%.

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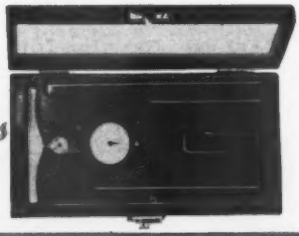

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Model 100 being used to align fixture in production mill.

- Every indicating problem now easily solved.
- No more indiscriminate clamping.
- All materials and workmanship unconditionally guaranteed.

NEW! 3-step universal rod for all indicators. Sizes ⅜", ½" and ⅝" diameters.

NEW! Ball-swivel and stem of non-magnetic material.

NEW! Sure-grip non-breakable tenite plastic case 1¼" wide, 1⅞" long and 1½" high.

NEW! Fool proof adaptor allowing 360° adjustment in all directions.

NEW! Magnetic pull 65 lbs.

PRICE $8.00 COMPLETE
Attractively boxed.

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No. 200	Magnetic base "HANDI-LITE" pull, 65 lbs.	$ 8.50
No. 250	Heavy duty magnetic base lighting unit—holds 100 watt bulb, pull, 125 lbs	$18.50

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ENCO MANUFACTURING COMPANY, Dept. 734
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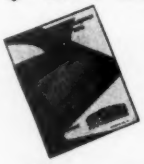
Order from your Enco Stocking Dealer, or send order with name of your mill supply dealer.

CIRCLE INFORM-A-GRAM KEY No. 126B

SUPERBORE COUNTERBORES

and drills in 3 sizes to do the job right!

SUPERBORE products are made of supertough fine-grade high-speed steel. Fore and aft precision grinding of flutes and pilot allow chips to flow out freely. As in the case of REAMERS, flutes are backed off to width of land to prevent heat generation, clogging or freezing. All ¾", 7/16" and ½" drills and counterbores have shanks of ½" diameter to fit that size drill chucks or collets.



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Straight Flute Right Hand Cut

18 - 4 - 1 Steel
STUB REAMERS IN DECIMAL SIZES
FOR REAL SAVINGS

Right-Hand Spiral Right Hand Cut

SUPEREAM STUB REAMERS

Left Hand Spiral Right Hand Cut

are suited exactly to your specifications in both standard and decimal sizes . . . .060 to .501 in stock. Other sizes ground in 3 to 4 days.

Right Hand Spiral Left Hand Cut

Chucking reamers . . . sizes .032 to .501 in stock

REAMERS or COUNTERBORES in SETS or single

High-speed fluted chucking reamers with straight shanks also ROSE high speed.

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LIBERTYVILLE 2-4200

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ROUTE 176 and BRADLEY ROAD
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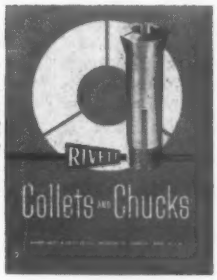
CIRCLE INFORM-A-GRAM KEY No. 126C

— QUICK-PIC CATALOGS —

News and Views of Current Literature

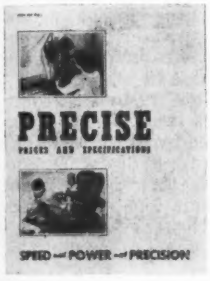
A New Collet and Chuck Bulletin, No. 100E, has just been issued by Rivett Lathe & Grinder, Inc., Brighton 35, Boston, Mass. The bulletin points out, among other things, that the method for mounting the work is equally important as the quality of the machine.

Circle Inform-A-Gram No. E1.



Gear Speeders. Having recently added two new machines to its line of gear speeders, the Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich., has now issued a new four-page brochure (Bulletin #MS-10) covering the complete line of machines that are presently available.

Circle Inform-A-Gram No. E6.



Prices and Specifications are included in this complete brochure on Precise equipment. Mentioned in the booklet are such products as the Precise Super 40 grinder miller and the Precise Vari-Speed lathe. This literature is available from Precise Products Corp., Racine 11, Wis.

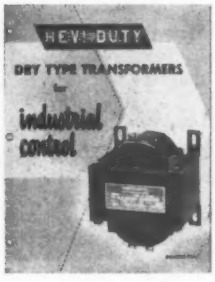
Circle Inform-A-Gram No. E2.

Brinell Hardness Testing Machines are described in this new catalog (Bulletin B 953) published by Steel City Testing Machines, Inc., 8817 Lyndon Ave., Detroit 28, Mich. Included are illustrations and specifications on different types of the hardness testers and accessories.

Circle Inform-A-Gram No. E7.

Control Circuit Transformers for machine tool and industrial controls are the subject of this generously illustrated brochure offered by the Hevi Duty Electric Co., 4212 West Highland Blvd., Milwaukee, Wis. Specifications and outline drawings are included in the bulletin (T-511).

Circle Inform-A-Gram No. E3.



Drilling Machines. Bulletin 3123-E of the Buffalo Forge Co., P. O. Box 985, Buffalo 5, N. Y., puts on display the firm's 19 different models of its No. 18 drilling machine. Illustrations and specifications also included on six other "Buffalo" drilling units.

Circle Inform-A-Gram No. E8.

Surface Pyrometer. This all-purpose instrument is for quick and accurate surface and sub-surface temperature readings. A "Quick-Pic" catalog giving features and instrument models available is yours for the asking from The Pyrometer Instrument Co., Bergenfield, N. J.

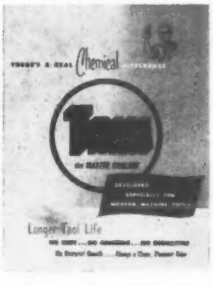
Circle Inform-A-Gram No. E4.

A New Trick For Checking I.D.'s! This bulletin explains the Diametrick Gage, a precision instrument for measuring "O" ring grooves and I. D.'s. The instrument is produced by the Mutual Engineering Service, 402 Court St., Saginaw, Mich.

Circle Inform-A-Gram No. E9.

Trim, The Master Coolant, developed especially for modern machine tools, is explained in an attractive brochure available from The Master Chemical Corp., 13 Huron St., Toledo 1, Ohio. Included in the booklet are sections on the properties and applications of Trim.

Circle Inform-A-Gram No. E5.



Precision Lapping in less time is explained in this brochure put out by the Spitfire Tool Co., 2931-35 N. Pukaski Rd., Chicago 41, Ill. It gives detailed information, plus illustrations and specifications on the various types of Spitfire precision lapping machines.

Circle Inform-A-Gram No. E10.

- *New Equipment*
- *New Materials*
- *New Literature*

WHAT'S NEW

Duplicating patterns for Keller or Gorton duplicating machines can be made at low cost from "Calcerite-A", a new plastic that will set fully at room temperature. This new tooling material, when cured, is very hard and dimensionally stable. Ask for Bulletin C-53. Furnane Plastics, Inc., 4516 Brazil St., Los Angeles 39.
Circle Inform-A-Gram No. F1.

"Electric Heat for Reinforced Plastics Production" is a detailed report that discusses advantages of electric vs. other heating media, and describes various applications of electric heat, the equipment needed, and the economical factors involved. Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.
Circle Inform-A-Gram No. F2.

Standard's new combination grinder and belt finisher

OFFERS ROUGH AND FINISH GRIND FOR HIGH SPEED STEEL AND CARBIDE TOOLS

Standard's leadership again offers users the convenience of "ONE STEP FROM ROUGH TO FINISH GRIND". Tools are rough ground on a silicon carbide wheel and then finish ground on an abrasive belt. The wear resistant platen permits uniform micro finish of end, top and side clearance angles on single point tools *without* diamond wheels or skilled operators. Also available with abrasive belt attachment only.

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Vari-Tool FINISHER
Price $497—FOB Cincinnati
Prompt Delivery

This Vari-Tool Finisher is the only versatile unit of its kind available today.

Standardize with the STANDARD electrical tool co.
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CIRCLE INFORM-A-GRAM KEY No. 128

Fast, continuous molding of small thermoplastic items is accomplished with the new Model 175T—4/6 oz. injection molding machine. With dry cycle time of six seconds, the new "Reed" develops 175 tons mold clamping pressure. While the normal shot capacity is four ounces, a stuffing arrangement permits a double shot of six ounces. Molds up to 24¼" x 13" are accommodated. For Circular 175T, write Reed-Prentice Corp., Worcester 4, Mass.
Circle Inform-A-Gram No. F3.

"Hand Lay Up of Molded Laminates" on vertical surfaces and compound curvatures can be accomplished with greater uniformity, without excessive resin drainage, and without starvation at high points. A special polyester resin—Marcothix Resin #1—does it. This resin may be easily applied by brush, squeegee, or spray, yet will not drain. Ask for Service Bull. 15 (154). Plastic Div'n, Celanese Corporation of America, 290 Ferry St., Newark 5, N. J.
Circle Inform-A-Gram No. F4.

A mold release liquid spray comes in a handy-to-use Aerosol can, gives a "smooth-coat" to mold surfaces, and permits easy release of molded part. Vin-Rock R-2 is crystal

clear and will not discolor any plastic nor affect the finishability of the product. Available from Vin-Rock, Inc., 8211 Almira Ave., Cleveland, O.
Circle Inform-A-Gram No. F5.

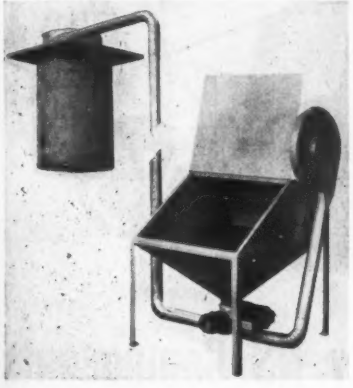
Vacuum forming machine, Model 50-20, is designed for automatic cycle operation on short-run forming of thermoplastic (heat-softening) sheets. Using low-cost male or female molds, the machine provides for clamping the sheet in position, heating it, drawing the softened sheet over the mold by evacuating air between sheet and mold, and releasing the formed part. Write Vacuum Forming Corp., Port Washington, N. Y.
Circle Inform-A-Gram No. F6.

IN PLASTICS?

- *Plastics Fabrication*
- *Plastic Tooling*
- *Plastics Molding*

"How to Make Laminate Plastic Drill Templates", using Anchor flanged drill bushings, is no longer a secret of the aircraft industry. Now available is the detailed basic procedure as developed by El Segundo Division, Douglas Aircraft Co., Inc. Laminate plastic templates, with bushings embedded after the curing operation, permit high hole-pattern accuracy in fabricating sheet metal components having compound curvatures. For copy of procedure, write to The Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif. **Circle Inform-A-Gram No. F7.**

High hoppers? Difficult to fill? Not when you use the pneumatic material hoist. Operator pushes button



to fill hopper from 800-lb. floor-mounted bin at 20-25 lbs./min. Eliminates work interruptions, dangerous scaffolding, and contamination of materials because of open hoppers. Injection Molders Supply Co., 3514 Lee Rd., Cleveland 20, O. **Circle Inform-A-Gram No. F8.**

A new semi-automatic vertical toggle press, Model 731, features the Stokes Bar Controller which permits calibrated control of all phases of the molding cycle by the simple movement of buttons on graduated bars. Approach, closing, and pressing speeds are independently adjusted. Resetting is done quickly by hand, even when press is operating. Press is designed for shock-free higher speeds and greater efficiency on parts requiring insert work, parts with both thick and thin sections, and those having pins and projections. Bulletin 516 is available from F. J. Stokes Company, Philadelphia 20. **Circle Inform-A-Gram No. F9.**

A high speed, 200-ounce, pre-plasticizing injection molding machine has been developed. With dry cycle time of 10 seconds, it is designed for primary use on such parts as refrigerator doors. Its versatility, however, lends itself to economical production of much smaller parts when needed. Features include high injection speed (200 oz. in three seconds), a positive shot measuring device, and a chamber which plasticizes independently of the machine cycle. For further information on the Model 1200-P-200, write to The Hydraulic Press Mfg. Company, Mount Gilead, O. **Circle Inform-A-Gram No. F10.**

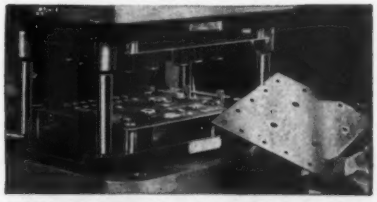
New • Fast • Proven

LOW COST methods for PERFORATING and NOTCHING SHEET METALS

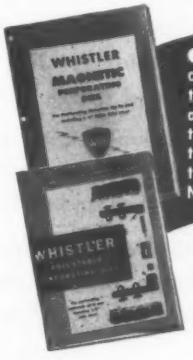
REDUCE DIE COSTS

All units and parts are interchangeable and used repeatedly in different arrangements. **INCREASE PRESS PRODUCTION**—*Down time is minutes as compared to hours for change-over.* For precision work in all types and sizes of presses. **START PRODUCTION AT ONCE.** Pierce materials up to ¼" thick mild steel. Standard sizes and shapes available up to 3 inches. Special sizes to order.

Whistler *MAGNETIC* Dies at work in large inclinable press. Magnetized retainers hold the units. No bolting required. A fast, economical method in making up a punch and die set for short or long runs. All parts re-usable.



Whistler *ADJUSTABLE* Dies on perforating and notching job, using Tee slotted die set. With Whistler Adjustable Punch and Die units production starts within hours instead of weeks. Last minute job changes made quickly.



● Here are the complete details with prices and application illustrations. Send for these catalogs. No obligation.

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4	19	34	69	91	106	121	134A	140C	144H	149A	152B	156B	162A	166G	170B
5	20	35	73	92	107	122	134B	141A	145	149B	152C	156C	162B	167A	170C
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11	26	64	82	98	113	125	137B	143	146F	150A	153B	158B	164B	168B	173
12	27	66.1	83	99	114	126A	138A	144A	146G	150B	154A	158C	165	168C	174
13	28	66.2A	85	100	115	126B	138B	144B	146H	150C	154B	158D	166A	168D	
14	29	66.2B	86	101	116	126C	138C	144C	147A	150D	154C	159A	166B	168E	
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A3	A16	A29	A42	B10	B23	B36	B49	B62	C6	C19	E5	F8
A4	A17	A30	A43	B11	B24	B37	B50	B63	C7	C20	E6	F9
A5	A18	A31	A44	B12	B25	B38	B51	B64	C8	C21	E7	F10
A6	A19	A32	A45	B13	B26	B39	B52	B65	C9	C22	E8	G1
A7	A20	A33	B1	B14	B27	B40	B53	B66	C10	C23	E9	
A8	A21	A34	B2	B15	B28	B41	B54	B67	C11	C24	E10	
A9	A22	A35	B3	B16	B29	B42	B55	B68	C12	D1	F1	
A10	A23	A36	B4	B17	B30	B43	B56	B69	C13	D2	F2	
A11	A24	A37	B5	B18	B31	B44	B57	C1	C14	D3	F3	
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A3	A16	A29	A42	B10	B23	B36	B49	B62	C6	C19	E5	F8
A4	A17	A30	A43	B11	B24	B37	B50	B63	C7	C20	E6	F9
A5	A18	A31	A44	B12	B25	B38	B51	B64	C8	C21	E7	F10
A6	A19	A32	A45	B13	B26	B39	B52	B65	C9	C22	E8	G1
A7	A20	A33	B1	B14	B27	B40	B53	B66	C10	C23	E9	
A8	A21	A34	B2	B15	B28	B41	B54	B67	C11	C24	E10	
A9	A22	A35	B3	B16	B29	B42	B55	B68	C12	D1	F1	
A10	A23	A36	B4	B17	B30	B43	B56	B69	C13	D2	F2	
A11	A24	A37	B5	B18	B31	B44	B57	C1	C14	D3	F3	
A12	A25	A38	B6	B19	B32	B45	B58	C2	C15	E1	F4	
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Just out . . . 32 well-illustrated pages, containing data on all Carmet grades, and on Carmet blanks, tools, die sections, punches, draw die inserts, etc.; also special preforming to order. ● *Write for your copy.*

ADDRESS DEPT. TP-51

Above are shown two carbide metal rolls of identical composition. The one at the left cost the user about nine times as much as the one at the right. That differential was due solely to grinding vs. non-grinding. The plain face needed serrating, whereas the ready-toothed face needed nothing.

In many uses where tolerances are not too critical, CARMET blanks *preformed* to your specifications are ready for service without additional costly grinding. On jobs where finish grinding is necessary, the quality of Carmet's preforming holds grinding stock to a minimum.

Hundreds of special shapes can be preformed in Carmet. For practical suggestions that fit your needs, call or write your nearest A-L representative. ● *Allegheny Ludlum Steel Corporation, Carmet Division, Wanda & Jarvis Avenues, Detroit 20, Michigan.*

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W&D 4048

AL® FINE TOOL STEELS SINCE 1854

CIRCLE INFORM-A-GRAM KEY NO. 133

IMPORTANT NOTICE

The Genuine MAUSER
VERNIER CALIPER

IS NOW MADE OF
STAINLESS STEEL
THROUGHOUT

The fine finish will not tarnish or deteriorate in many years of use.

NEW #101

$14.75 POSTPAID

AND THE FOLLOWING IMPROVEMENTS HAVE BEEN ADDED

★ A SPECIALLY LONG VERNIER to read the thousandths
★ A HARDENED PHOSPHOR-BRONZE adjustable gib retains accuracy
★ 3 EASY READING SCALES • 1/1000" • 1/128" • 1/10 mm. in back

Request illustrated Folder showing complete line of MAUSER Toolmakers Calipers, Height gages, Bevel Protractors and Tool Stands.

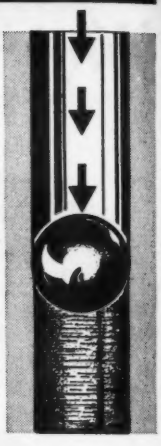
Dealers: Here's a real profitable line!

GEORGE SCHERR CO., INC.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-T LAFAYETTE ST. • N.Y. 12, N.Y.

CIRCLE INFORM-A-GRAM KEY NO. 134A

BALLIZING

For NEW Speed and Economy in Hole Sizing and Finishing



BALLIZING is a precision high-production process for sizing and finishing die-cast, drawn, and machined holes — simply by pressing a ball through the unfinished hole. With alloy steel and tungsten carbide balls available in practical quantities and in any size required, this process is used with holes of all diameters.

MAJOR ADVANTAGES:

FAST; takes only seconds. ACCURATE. FINE FINISH — burnished smooth. ECONOMICAL. Uses unskilled labor. No tool sharpening. No close adjustments. No special equipment.

FREE BALLIZING BULLETIN gives details; shows typical applications. May we send you a copy?

INDUSTRIAL TECTONICS, Inc. ANN ARBOR 7, MICH.

ITI PRECISION BALLS
All Materials — All Sizes
In Large or Small Quantities

CIRCLE INFORM-A-GRAM KEY NO. 134B

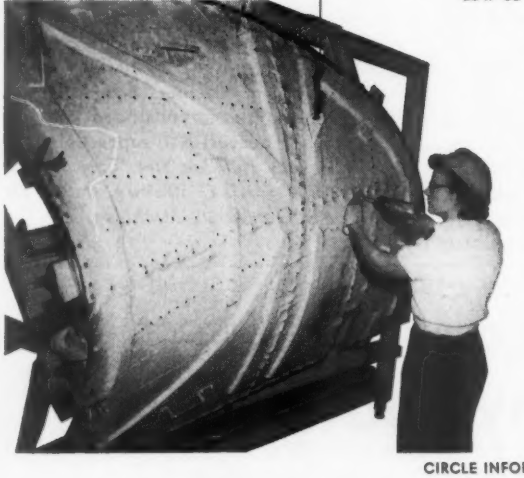
eliminate COSTLY drill fixtures with "laminate plastic" ANCHOR BUSHING drill templates

Laminate plastics and Anchor Bushings are combined to make lightweight drill templates at far less cost and tooling time than required to produce conventional heavy drill fixtures.

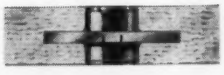
Laminate plastics, formed over wood, metal, clay or plaster and heat or air cured, match any desired size, shape or compound curve. Using hardened steel Anchor Bushings in laminate plastic templates, proper hole coordination is provided for low or high volume production.

Specifically designed for laminate plastics, Anchor Bushings can be imbedded within the plastic material during lay up or rivet attached afterward.

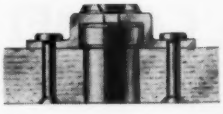
Write for folder describing how to make laminate plastic templates and for the Anchor Bushing Catalog.



At Douglas Aircraft Company — Long Beach Division, this large laminate plastic Anchor Bushing template is used to drill compound curved fillet for C-124 Globemaster airplane.



One piece Anchor Bushing imbedded in laminate plastic during lay up.



Two piece long pilot Anchor Bushing riveted to finished tool.

Anchor Bushing types, other than shown above, are also available for laminate plastic drill templates.

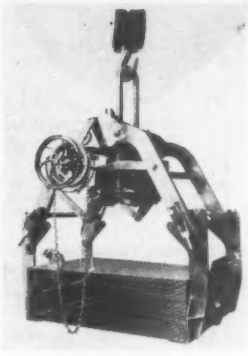
THE *hi-shear* RIVET TOOL COMPANY
8924 BELLANCA AVENUE • LOS ANGELES 45, CALIFORNIA

CIRCLE INFORM-A-GRAM KEY NO. 134C

PROGRESS ON PARADE

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS ——— Mail FREE Inform-A-Gram Card for MORE Details

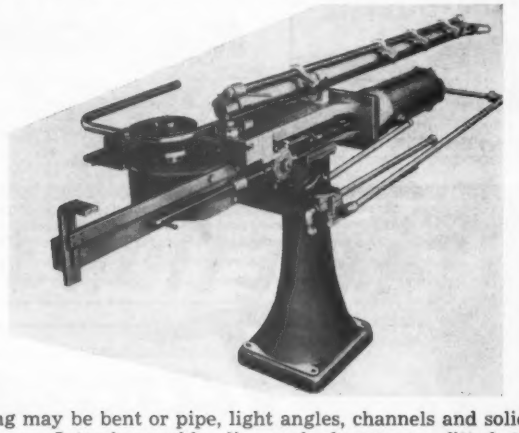
Material Handling Tool. A one man operated sheet and coil lifter, capable of handling up to 20,000 lbs. of sheet or coiled steel stock. has recently been put on the market by the Cullen-Friestedt Co., 1300 S. Kilbourn Ave., Chicago, Ill. A wide range of sheet and coil stock may be handled by the new lifter because it has an infinite number of opening and closing adjustments of the jaws. Write for additional data.
Inform-A-Gram No. A1.

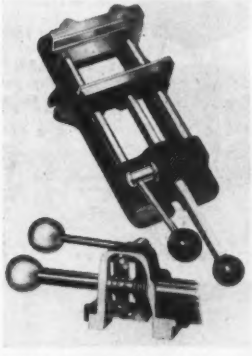


Vertical Milling Machines. A new efficient, economical answer to accurate, versatile, vertical and angular milling problems is being offered in the form of the "United States Vertical" milling machine made by the U. S. Burke Machine Tool Div., Cincinnati Mfg. Corp., Cincinnati 27, Ohio. Among the features of the machine is the table which provides an expansive 9½" by 36" working surface. Quill travel is 5½ inches. Further data available. **Circle No. A2.**

Vibratory Feeder. The Detroit Power Screwdriver Co., 2801 W. Fort St., Detroit 16, Mich., announces an addition to its line, the DPS Bowl Feeder. This device provides fully automatic, oriented, single line feeding to grinding, packaging, inspecting and other automatic machines and operations. Additional data available.
Inform-A-Gram No. A3.

900 Bends Per Hour is the work you can get out of this air compression tubular bending machine made by the Paul Machine Tool and Die Works, 4600 S. Kedzie Ave., Chicago 32, Ill. Round, square or rectangular tubing may be bent or pipe, light angles, channels and solid bars. Interchangeable dies and clamps are fitted to the machine quickly to handle various sizes of shapes of stocks. Literature is available. **Inform-A-Gram No. A4.**





"Instant-Action" Grip-Master Vises that permit clamping of compressible materials has been introduced by Heinrich Tools, Inc., Racine, Wis. With an instant, effortless action, this clamping device compresses and securely holds difficult to hold material. Write for additional data. **No. A5.**

Air Pencil Die Grinder. The speed of this air power tool is 40,000 rpm. It is of all steel construction with a 3-bladed air motor—not a turbine—power at high speed. Additional data is available from the Rotor Tool Co., 26300 Lakeland Blvd., Cleveland 23, Ohio. **Circle No. A6.**

Added Safety has been built into the newest Nu-Jett pencil grinder, the 100,000 rpm grinder made by Nu-Jett Products, 1355 Michigan N.E., Grand Rapids, Mich. The newest model has a safety guard which fully encloses the chuck nut. **Circle Inform-A-Gram No. A7.**

CHALLENGE
Surface Plate Equipment

MADE OF HIGH-GRADE SEMI-STEEL — HEAT TREATED AND PRECISION GROUND

STRAIGHT EDGES — For scraping planer and lathe bed ways . . . parallel straight edges for inspection of alignment and bearing surfaces of machine tools.

RIGHT ANGLE IRONS — May be placed in almost any position with work clamped to face for measuring . . . Also used as height blocks.

ANGLE PLATES — Made in 22 sizes from 2¾ x 4¾ x 4¾ up to 24 x 24 x 24 for clamping and holding work.

V-BLOCKS — Feature ribbed sides, light weight and a V accuracy of .0005 inch . . . for supporting shafts for drilling, checking, etc.

BOX PARALLELS — Complete range of sizes for every use . . . Accurate to .0005 inch.

Send for complete information

THE CHALLENGE MACHINERY COMPANY
Office, Factories and Show Room:
Grand Haven, Michigan

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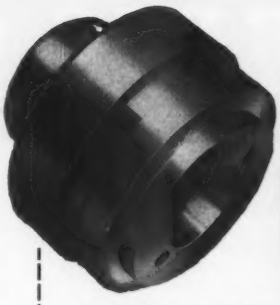
Challenge

TRADE-MARK ®

CIRCLE INFORM-A-GRAM KEY NO. 136A



new... LOVEJOY CIF COUPLING

CIF Coupling: 1 to 64 hp. at 100 rpm . . . max. bore 1⅝ to 5⅞.

★**COMPACT** — fits right into the flywheel . . . saves space required by conventional hub length

★**ECONOMICAL**—elimination of one flange affords cost saving over standard flywheel couplings

★**MAINTENANCE FREE**—cushions changed without shutdown . . . no lubrication required

LOVEJOY Flexible Couplings provide maximum alignment correction, extra-smooth power transmission . . . absorb vibration, starting torque and shock of intermittent loads . . . assure optimum motor and machine performance. Cushions are made of materials best suited to load conditions.

There's a LOVEJOY Flexible Coupling for every requirement

Write today for Catalog and Handy Selector Charts

LOVEJOY FLEXIBLE COUPLING CO.

4819 W. LAKE STREET CHICAGO 44, ILLINOIS

Mfrs. of Universal Joints, Variable Speed Pulleys and Transmissions.

CIRCLE INFORM-A-GRAM KEY NO. 136B

FRICTION SAWING WITH Tannewitz HIGH SPEED BAND SAWS

GREATEST COST SAVER IN METAL CUTTING

Tremendous savings of time and money are effected in trimming formed parts with Tannewitz High Speed Band Saws, for not only are the cuts made exceedingly fast, and smoothly, but in most cases no jigs or rests of any kind are required. Sheets of both hard and soft steel, and even such metals as 1" armorplate are handled with great advantage by this method, and it is ideal for trimming malleable and steel castings. By all means get the complete facts and learn of the many opportunities for boosting production and lowering costs that Friction Sawing with Tannewitz High Speed Band Saws offers. Write for circular.

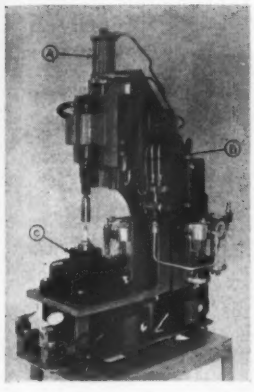
for trimming castings of all metals write for bulletin on "Foundry Band Saws".

GL-6-1729

SAWING MACHINERY SPECIALISTS

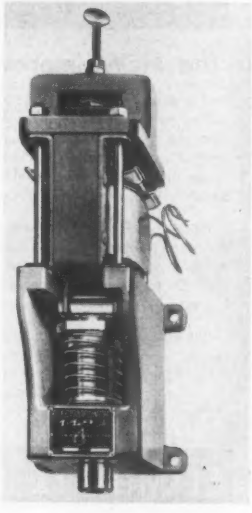
The TANNEWITZ WORKS GRAND RAPIDS MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 136C



This Air Unit speeds spark plug assembling. It is a combination of electrical and pneumatic devices which drives home the locking nut on Duchess spark plugs with a minimum of time and effort. The machine was designed and built by the Crusota Engineering Co. of Springfield, Mo., using a number of standard Mead units. Further information is available from the Mead Specialties Co., 4114 N. Knox Ave., Dept. LS-93, Chicago 44, Ill.
Inform-A-Gram No. A8.

A New Compact Electric Impact Hammer, Electro-punch, Jr., has been introduced by Black & Webster, makers of solenoid operated tools. It is a packaged unit suitable for fixed, single-purpose applications where controlled impacts up to 3500 lbs. are required. It is well suited for use in larger machines where a specified blow or impact is desired as one phase of the over-all operation. It is particularly suitable for staking, riveting, marking, cutting, blanking, forming and drawing of metals, plastics, fabrics, leather, etc. Detailed information is available from Black & Webster, Inc., Dept. 90, 445 Watertown St., Newton, Mass. **Circle No. A9.**



Precision Boring. For straight and taper boring and turning; contour boring and turning; grooving and recessing; facing. counterboring, chamfering and combinations of these operations, the Ex-Cell-O Corp. presents its Style 17 Precision Boring Machine. It is described in detail in the firm's Bulletin 31205. Write to the Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Circle Inform-A-Gram No. A10.

NOW! SAVE ON SET-UP TIME!

With Faster Cutting
D-M-E TAPERED MILLING CUTTERS

MACHINE ANGLES, DRAFTS or RELIEFS **TOPS IN SMOOTH CUTTING PERFORMANCE**

WITHOUT TILTING THE MACHINE HEAD OR THE WORK PIECE!

You can take Faster, Smoother cuts, WITHOUT CHATTER. Made from the finest High Speed Steel to prevent breakage and costly "down time". You'll save Time and Money with D-M-E Tapered Milling Cutters!

FREE! Write for your convenient TABLE OF DRAFT ANGLES. Gives the actual decimal amount of draft or relief for any given depth of all angles from ½ to 30 degrees.

HIGH SPEED STEEL

3 FLUTES For Finer Finish

IN STOCK!
From ½° to 7° per side
Write TODAY for Data Sheet 522

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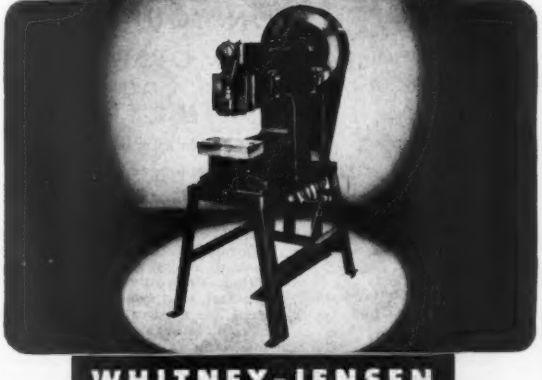
WHITNEY METAL
TOOL COMPANY
39 YEARS EXPERIENCE



WHITNEY-JENSEN
Nos. 129 - 130
DEEP THROAT POWER PUNCH PRESSES
These efficient presses feature: high speed, deep throats, all steel welded frames, inexpensive auxiliary attachments, various punches and dies from stock. They have a 5-ton safety factor.
Throat Depths — 12" and 18"
Capacity — 10 tons

WHITNEY METAL TOOL COMPANY
724 FORBES STREET, ROCKFORD, ILLINOIS

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STOCK REEL

LOW COST — AUTOMATIC

No motors — No belts — No sprockets

POWERED BY THE NATURAL SPRING OF UNCOILING STOCK . . .

JACO Stock Reel operates automatically . . . without attention or maintenance . . . so simple there is nothing to get out of order.

The loop of stock between the Coil and the Press Feed completely eliminates slippage, kick-back and over-run.

JACO Stock Reels handle all types of resilient coiled stock for light stampings up to 250 lb. coil weight . . . up to 36" coil diameter . . . up to 6" stock width.

Proved in actual use by major manufacturers.
Guaranteed to work on your job or money back.

Write today for full details

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JACO DEVICES, INC.

96 High Street
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CIRCLE INFORM-A-GRAM KEY NO. 138A

Fast-Precision Tapping Made Easy!

Check These

VIKING

FEATURES

- Cuts tapping time 80%
- Takes jobs up to 18" in height
- Less breakage saves taps
- Needs only unskilled labor
- No vise necessary

The NEW Improved VIKING Tapper

Fast precision tapping made easy with the new Viking Tapper, unskilled help can tap more holes in less time—and the work is more accurate and uniform. For example, a perfect ¾"—10 hole can be tapped in ¾" heavy tool steel in one minute. Saves taps too because there is far less breakage. In fact the saving on taps alone soon pays for the Viking Tapper.

Another important feature is extreme flexibility. Unique adjustable arm which can easily and quickly be raised or lowered, swung left or right, takes jobs up to 18" in height and requires less resetting. Sliding parallel bars hold work—no vise needed. Quick changing adapters take only 5 seconds to change taps.

Stand or bench model. Adapters available in eight sizes. Write for full information. THE VIKING TOOL AND MACHINE CORP., 6 Main Street, Belleville 9, N.J.

CIRCLE INFORM-A-GRAM KEY NO. 138B

INCREASE PRODUCTION.. SAVE TIME & MONEY

ON YOUR DRILLING OPERATIONS

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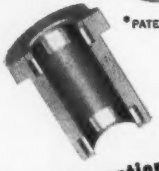


MEYCO

Carbide Inserted Bushings last longer, cost less in the long run

Here is a bushing that combines the best features of steel and carbide; the strength of steel and the long life of carbide. First cost: slightly higher than ordinary steel bushings; their life: many, many times as great. In addition to such obvious savings, MEYCO bushings increase the life of drills and reamers, produce accurate work for a longer period of time, save on machine-down time and on nonproductive man-hours.

☆

Auto manufacturer says: "... the steel bushings previously used averaged about 28 hours life. MEYCO bushings ran 1,168 hours before they were unusable."

For information and prices write for Meyco Bushing Catalog No. 17

W. F. MEYERS CO., INC., BEDFORD, INDIANA

CIRCLE INFORM-A-GRAM KEY NO. 138C

ELIMINATE HUMAN ERRORS WITH INDICATING MICROMETER & COMPARATOR

COMPARATOR MASTER MICROMETER GO-NO GO GAGE 1" RANGE IN 10000ths - NO GAGE BLOCKS NEEDED

*** HUMAN ERRORS THROUGH DIFFERENCES OF "FEEL" ELIMINATED. WILL DETECT OUT-OF-ROUNDNESS, OVALNESS AND TAPER.**

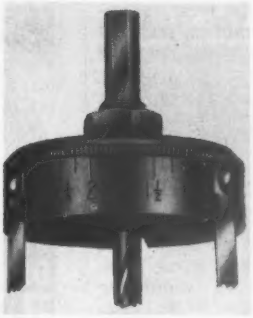
SEND FOR ILLUSTRATED CIRCULAR

GEORGE SCHERR CO., Inc.

200-T LAFAYETTE ST. • NEW YORK 12, N.Y.

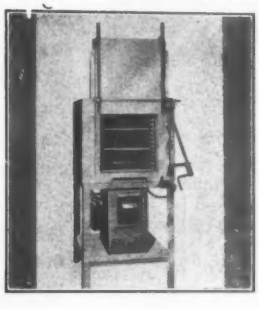
CIRCLE INFORM-A-GRAM KEY NO. 138D

A Dial Saw and Rotary Planer recently developed by Erwood, Inc., for hole cutting includes an instantaneous adjustment feature. A twist of the calibrated dial will adjust 3 sliding blades to cut any size hole from 1⅛" to 2½". For further data contact Erwood, Inc., 1770 W. Barteau Ave., Chicago 13, Ill., or—
Inform-A-Gram No. A11.



New Internal Comparator. This gage is used for internal measuring, such as inside diameters. It has a capacity for gaging diameters from ⅜" to 6". It is suitable for work on jig borers, boring machines, internal grinders and lathes. The Portage Double Quick Tool Co., 1046 Sweitzer Ave., Akron, Ohio, offers additional information. **No. A12.**

Air Draw Furnace. Among the features of this new automatic recirculating air draw furnace is a door which automatically self-locks at any position between closed and full open. The furnace can be used in laboratories, pilot plants and industry for more critical heat treatment of steel and alloys up to 1350° F. Further information available from the Blue M Electric Co., 306-8 W. 69th St., Chicago 21, Ill. **No. A13.**



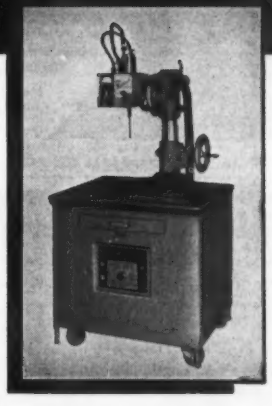
Increased Efficiency in the handling of very small parts is available with the new and smaller NesTier materials handling unit. Made of 20 gauge steel, it is capable of handling 200 lbs. with standard handle and 400 lbs. with heavy duty handle. It weighs 3 lbs. and has a volume of 238 cu. inches. It measures 12" long, 7¼" wide and 4¾" deep. For further information write to C. W. Doepke Mfg., Rossmoyne, Ohio. **No. A14.**

Sweep Guard. This is a positive safety guard for operator protection on forming and secondary power presses operations. Attached to and actuated by the press, two guard arms push the operator's hands away from the danger zone as the ram starts to descend. Data available from Durant Tool Supply Co., 155 Orange St., Providence 3, R. I.
Inform-A-Gram No. A15.

METAL DISINTEGRATION

and what it can do for you

Remove broken taps fast without distortion
Cut any shape hole in cemented carbides
Cut dovetails in hardened dies
Cut oil holes in hardened gears without annealing



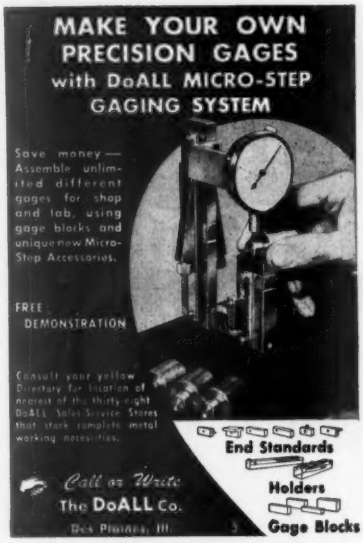
Literally hundreds of thousands of dollars are saved annually by corporations that are using Metalmasters in just tool and die repair alone.

There's a technical engineer in your area to give you an on-the-spot demonstration in your own plant at your convenience. (NOTE: It is not uncommon to pay for a Metalmaster with just one short demonstration through savings on workpieces.

There's a Metalmaster designed for your operation and priced to fit your needs. For information as to the many uses and benefits Metalmaster can offer you, write today on your company letterhead to:

Metalmaster
DIVISION OF CLINTON MACHINE COMPANY
CLINTON, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 139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PRECISION GAGES
with DoALL MICRO-STEP
GAGING SYSTEM
Save money—
Assemble unlimited different gages for shop and lab, using gage blocks and unique new Micro-Step Accessories.
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Consult your yellow Directory for location of nearest of the thirty-eight DoALL Sales-Service Stores that stock complete metal working necessities.
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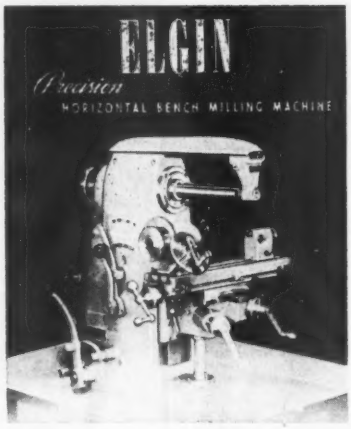
CIRCLE INFORM-A-GRAM KEY NO. 140A

SPECIFY KASSON PRECISION
COLLETS AND ATTACHMENTS
IMMEDIATE DELIVERY FROM STOCK
3AT, 3C
1A, 4C
5C
480
(AC-50)
All collets in hexagon, square and round.
KLUTCH-KOLLET
Step collet for accurate chucking to 2¾" dia. Soft head for easy boring. Lowest price on market! Models 3AT, 3C, 5C.
FOR ATLAS • LOGAN • SOUTH BEND
CRAFTSMAN • SHELDON LATHES, ETC.
LEVER-TYPE
DRAWBAR
½" cap.
Positive grip on undersize, oversize or standard diameter work! Patented coordinate cams eliminate fingers.
Let us quote on your quantity orders for any type of collet, live center or other machine tool attachment!
HAND
DRAWBAR
½" cap.
LIVE CENTER
(Ball Bearing) Double sealed for accuracy.
KASSON
Precision
KASSON Precision products are guaranteed unconditionally for accuracy, fit and long life. Your dealer should have them . . . Write us for literature!
KASSON DIE AND MOTOR CORP.
Formerly General Die & Stamping Co.
264 MOTT ST. • NEW YORK 12, N.Y.
Integrity Since 1919

CIRCLE INFORM-A-GRAM KEY NO. 140B

A New Index Table recently announced by Air-Hydraulics, Inc., 264 Belden Rd., Jackson Mich., features

adjustable speed and cushion. The table operates on ordinary line pressures from 60 to 175 lbs. Complete information is available. **No. A16.**



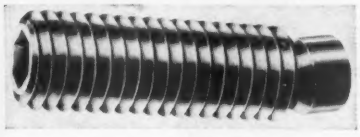
Information on this precision horizontal bench milling machine is available in a folder offered by Elgin Tool Works, Inc., 1770 Berteau Ave., Chicago 13, Ill.
Circle Inform-A-Gram No. A17.

Belt Grinder. Designed to deburr, grind and polish the inside and outside surfaces with equal ease, this power belt grinder comes in bench and portable models. All models are equipped with automatic belt tension, sealed bearing idler pulley and platen banking on one side for flat surface work and unbacked belt on the opposite side for contour polishing. Descriptive literature is available from the United Machine Tool Co., 1911 Clyde Park Ave., S. W., Grand Rapids, Mich.
Circle Inform-A-Gram No. A18.

Lower Your Die Costs . . .
GET
QUICKER and BETTER
FILING, SAWING and
LAPPING with . . .
OLIVER
DIE MAKING MACHINES
PLANTS of ALL SIZES
REPORT SAVINGS up to 60%
Oliver Die Making Machines are so simple to operate that skilled labor is not needed. They increase toolroom efficiency . . . cut costs . . . assure precision perfection. Four decades of experience and more than 10,000 installations throughout the world vouch for the superiority and long life of Oliver Die Making Machines.
Start saving money now. Do sawing, filing and lapping the proved way . . . the Oliver way.
OLIVER DIE MAKERS
Available in 5 Models
The Bench Model S-1 (illustrated) is a single speed die maker for use on tool steel up to 1" thick.
The Heavy Duty Model (illustrated) has 4 speeds, works in metal up to 3" thick, has variable strokes to 5" with hydraulic feed.
Write Today For Complete Technical Data on OLIVER DIE MAKERS
See our catalog in Sweet's Directory
MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES
OLIVER INSTRUMENT CO.
1416 E. MAUMEE • ADRIAN, MICHIGAN

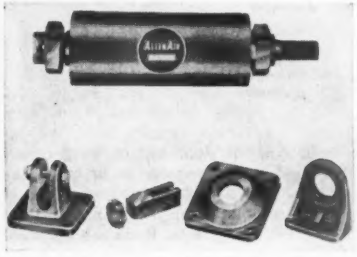
CIRCLE INFORM-A-GRAM KEY NO. 140C

New Self-Aligning Rest-Pad. A new automatically self-aligning rest pad for jig and fixture work has been introduced by Vlier Engineering, Inc., 4552 Beverly Blvd., Los Angeles 4, Calif. This pad elimi-



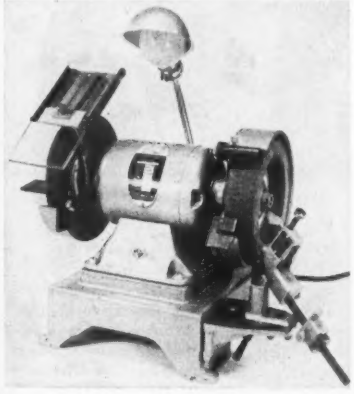
nates damage and marring, adjusts itself for uniform pressure work and because of a highly polished steel ball provides almost frictionless bearing surface for rotation and oscillation.
Circle Inform-A-Gram No. A19.

Double Acting Cylinders for air, water or L.P. hydraulic operation are now available in 1⅛", 2" or 3-inch bore; any stroke, and with sin-



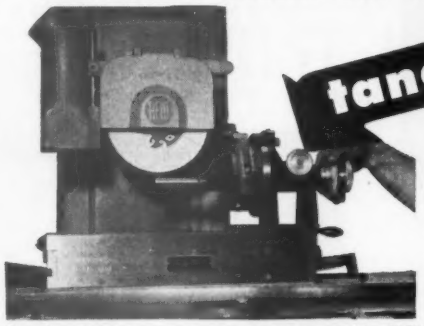
gle ended or double ended piston rods. Further information can be obtained from the A. K. Allen Co., 57 Messerole Ave., Brooklyn 22, N. Y.
Circle Inform-A-Gram No. A20.

Tool & Drill Grinder. Simplicity, convenience, accuracy and speed are emphasized in the design of this new, low cost, wide range tool and drill grinder. An unusually wide range of twist drills from #60 wire size to ¾", are quickly and accurate-



ly pointed and sharpened with this new unit. It permits the grinding of point angles from 117° to 135°. For ance angles from 6° to 15° and chisel point edges from 117° to 135°. For additional information write the Do-All Co., Des Plaines, Ill.
Circle Inform-A-Gram No. A21.

You dress better for less with tangi-matic



Reid Bros. Surface Grinder dressing with a Perfex TANGI-MATIC

RECOMMENDED BY LEADING MANUFACTURERS OF SURFACE GRINDING EQUIPMENT

Now you can dress angles tangent to radii within "tenths" and set-up in one-fourth the time with the new TANGI-MATIC Dresser. A *built-in*, direct-reading micrometer eliminates "mikes", height gages, Jo Blocks and errors—and saves you time. Even novice operators obtain extreme accuracy.

TANGI-MATIC dresses any concave radius down to .032", full 180°. Set-up can be made without removing dresser from your grinder chuck. A removable dressing arm permits the use of extensions for large wheel dressing.

Wearing surfaces are hardened, ground and lapped for assurance of years of extra service over ordinary dressers. Lead screw is hardened and ground to extreme tolerances.

TANGI-MATIC is furnished complete with master setting block, small radius attachment, plastic hood and carrying case.

WRITE FOR FREE LITERATURE AND NAME OF OUR REPRESENTATIVE IN YOUR AREA

ACCURACY PERFEX OUR CREED **PERFEX GAGE & TOOL CO.**

124 Avery St. • Mt. Clemens, Mich.

CIRCLE INFORM-A-GRAM KEY NO. 141A

BUSHING BONDING CEMENT

For Retaining Drill Jig Bushings
Use B-K 7 # CEMENT

No distortion of the jig plate or misalignment of the hole pattern. Eliminates lapping of press fit bushings after assembly. Not affected by drilling heat. Bushings can be retained in steel, aluminum or fiberglas jigs. Easily applied by untrained personnel. Especially recommended for use in "master tooling" operations.

SHERIDAN PRODUCTS
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CIRCLE INFORM-A-GRAM KEY NO. 141B

HARDENED and GROUND HSS BLANKS

Any decimal diameter to ½"—in any length. Mirror finish surface to gage tolerance. Many uses — punches, gages, measuring wires, special tools, etc. Quick delivery.

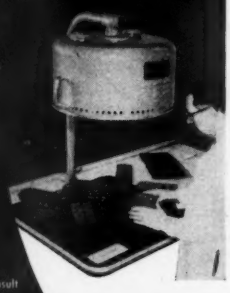
Write or Phone ORange 3-4301 for price list D-3

WILLIAM T. HUTCHINSON COMPANY
235 Main St. Orange, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 141C

DoALL 20" MONOLIGHT
lets you inspect flatness of large surface areas or groups of parts

- Checks flatness in millionths
- 30" x 30" work area
- 20 foot-candle intensity
- Mercury light

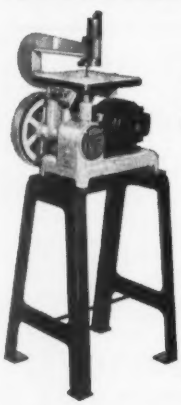


Call DoALL — consult yellow directory for nearest DoALL Service-Store that stocks cutting tools, gages, supplies—or Write

The DoALL Co.
Des Plaines, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 142A

CUT TOOL AND DIE-MAKING COSTS WITH . . . Milwaukee DIE FILERS PROFILE GRINDERS



DIE FILERS
. . . for straight-line sharp corner filing, sawing and lapping

This low cost precision-built unit performs all die making operations at savings up to 40%. Furnished complete with motor and two overarms. No extras to buy.

Write for illustrated Bulletins and Prices

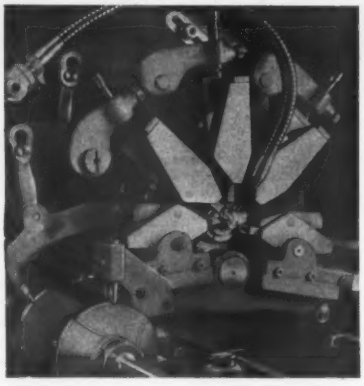
PROFILE GRINDERS
. . . for high speed Precision Grinding of curved and Irregular Contours

Standard features include 20,000 or 30,000 R.P.M., or a combination of these spindle speeds, ½ H.P. motor, Collet Chuck, Compound tilting table, built-in wheel dresser.

RICE PUMP & MACHINE COMPANY
228 Park Avenue Belgium, Wisconsin

CIRCLE INFORM-A-GRAM KEY NO. 142B

A New Swiss Type High Precision Automatic Lathe, to be known as the Howard D-500, provides extreme accuracy, concentricity and very high finish in the mass production of small, slender parts. The tool head shown carries two rocker operated

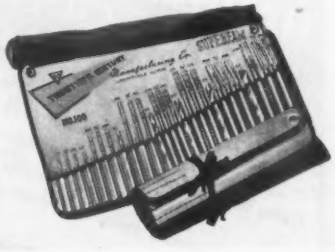


tool holders used for the heavy turning, and three radially operated tool holders used for plunging and cut-off. Further information is available from the Detroit Cam & Tool Co., 195 W. Nine-Mile Rd., Ferndale 2, Mich. **Inform-A-Gram No. A22.**

A New Diamond Dressing Tool that cuts the cost of diamond wheel operation and assures longer carbide tool life between grinds has been developed by the United States Diamond Wheel Co., Aurora, Ill. The

device is a hand hone, tipped with diamond concentrate and with a new feature that insures more accurate operation—"finger-tip control." It is available in single or double end styles and in all required Diamond Grit sizes. Complete literature upon request. **Inform-A-Gram No. A23.**

New Plastic Kit for Drill & Reamer Set. Twentieth Century Mfg. Co., offers a full set of chucking reamers and drills in decimal sizes.



The kit can be conveniently rolled into a compact package or hung on a wall or bench. Write Box 429 TP Libertyville, Ill., for literature, or—**Circle Inform-A-Gram No. A24.**

Get ALL the Advantages OF THE MOTCH & MERRYWEATHER Triple-Chip Saw Blade in 2 Types..

1 CUT-OFF SAWS

SEGMENTAL — 11" through 108" diameter

SOLID — 8" through 20" diameter

Reduce scrap! Raise production! M. & M. has a segmental or solid Triple-Chip blade for every material, shape and size. You profit from highest practical speeds. Ends are square and burrless, and pieces meet close tolerances. Re-sharpen at low cost.

Fifty Years 1904 • 1954

2 SLITTING & SLOTTING SAWS

ANY SIZE — ANY THICKNESS

Triple-Chip Saw Blades produce curling, self-clearing chips. Stresses are relieved, breakage minimized. The Dual Drive feature makes keyways unnecessary. Adaptor keyed to arbor permits blade interchangeability.

THE MOTCH & MERRYWEATHER MACHINERY CO.
Cutting Tool Manufacturing Division
CLEVELAND 17, OHIO

Triple-Chip METHOD

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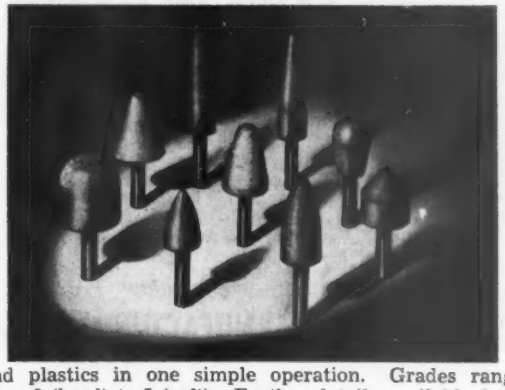
Only M & M builds ALL 3:

CIRCLE INFORM-A-GRAM KEY NO. 142C

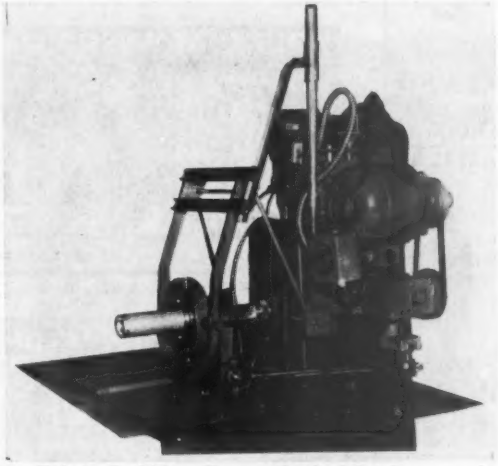
Nu-Tex Mounted Points. Designed for use on all types of precision instruments and machinery, Nu-Tex mounted points feature a soft, cushion-like grinding action that cleans, polishes and deburrs all types of metals



and plastics in one simple operation. Grades range from 0 (hard) to 5 (soft). Further details available from Atlantic Abrasive Corp., South Braintree 85, Mass.
Circle Inform-A-Gram No. A25.

Dial Indicator. This precise and accurate instrument utilizes a steel band transmission instead of the conventional rack and pinion method. Features of the band transmission are the fact it can be manufactured with great accuracy and that it functions as a shock absorbing safety device. Also, a constant measuring pressure on the anvil over its entire range is assured by a measuring pressure compensator. Further information can be had from Homestrand, Inc., Larchmont, N. Y.
Inform-A-Gram No. A26.

Honing Machine Attachment. A low priced automatic stroking and timing attachment for converting manually operated honing machines into automatic units has been developed by the National Pioneer Co., 1134 Nebraska



Ave., Toledo 7, Ohio. Even spherical honing, previously deemed impractical, is now placed in the realm of economical manufacture by means of this special attachment. Further information available upon request.
Circle Inform-A-Gram No. A27.

INDIVIDUAL VULCANAIRE
DUST COLLECTING UNITS

They are used on surface and other grinders where grinding dust must be removed.

Inexpensive, compact units, with no moving parts. Operated from your present air supply.

Installed in a few minutes, eliminating need for costly centrally located dust collecting systems.

The collector element is mounted on the side of the machine. Quickly cleaned, requiring no refills.

Vac-suction pick-up device (vacuum nozzle) is mounted on the grinding wheel guard or close to grinding wheel on other applications. This mounting permits constant contact with dust as the wheel is moved up or down.

A simple needle valve operates the unit, and can be shut off whenever the machine is not in use.

Available in 700 series for grinding wheels 7" dia. or less.

Made by the makers of Vulcanaire The jig grinding attachment.

WRITE on your letterhead for "Dust Collector" Booklet.

VULCAN TOOL CO.
PRITZ STREET • DAYTON 10, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 143

DoALL OPTICAL FLATS

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A size and type for every job

- Purest Quartz
- Accuracies to .000001"
- Diameters to 10"
- Special sizes, shapes made to order

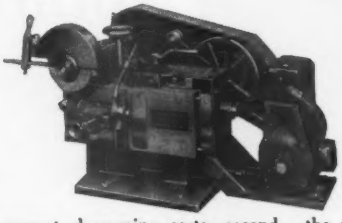
Consult your yellow Directory for location of nearest of the thirty-eight DoALL Sales-Service Stores that stock complete metal working necessities.

Ask about DoALL Monolights—2" 5", 20" sizes

Call or Write The DoALL Co.
Des Plaines, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 144A

LESS THAN 5c EACH SHARPENS SAWS IN GANGS



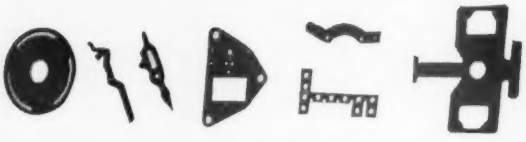
Don't pay 20c each or more to sharpen small millers of screw slotting saws, (2" to 5½" diameter,) when the 35 T will completely recondition them, restore broken teeth and automatically make your saws like new for less than a nickel each. Accurate to ± .001". You will quickly get back the *small cost* of 35 T in the double savings it brings you. First — the money you save on present sharpening costs—second — the money you save on reduced purchases of new saws — you buy fewer saws because they last so much longer.

Write for Bulletin 35 T

WARDWELL MANUFACTURING CO.
Maker of largest line of saw and tool sharpening machines
3809 Ridge Road
CLEVELAND 9, OHIO

CIRCLE INFORM-A-GRAM KEY NO. 144B

STAMPINGS---SHORT RUNS



A dependable service for small quantity requirements for new developments and production up to 50,000 pieces. QUICK DELIVERY — ACCURACY — backed by 23 years' experience.

Linden 3-4100 **SMALL LOT STAMPING CO.**
1025 W. Blancke St. "Dedicated to Short Runs" Linden, New Jersey

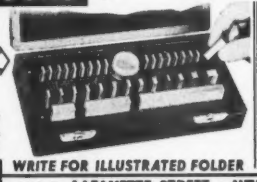
CIRCLE INFORM-A-GRAM KEY NO. 144C

ULTRA-CHEX GAGE BLOCKS *for Every Need!*

Supplied in one Superior Accuracy
5 MILLIONTHS ± ACCURACY

34 BLOCK SET (shown)...$125 INCL. OPT. PARALLEL
82 BLOCK SET.....$275 IN CASE

These sets will supply the needs of any discriminating shop that must work to gage-block precision. IMMEDIATE DELIVERY



WRITE FOR ILLUSTRATED FOLDER

9 Block Set
For Individual Mechanic
$22.50
OPTICAL PARALLEL
$5.00 Extra

GEO. SCHERR CO., INC. 200-T LAFAYETTE STREET • NEW YORK 12, N. Y.

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Why SCHNORR Disc Springs?

BECAUSE

1. Unlimited life within borders of permissible loads.
2. No creeping, initial settling or gradual fatigue.
3. Axial center pressure.
4. Exact adjustment to the desired pressure.
5. Small constructional height, large deflection.
6. Large inherent damping.
7. Large impact damping especially with multiple stacking.
8. Excellent space disposition.
9. Spring pressure, Spring length and Spring deflection can be easily determined for the same Spring size or can be changed by lengthening or shortening of the Spring columns or by multiple stacking. In special cases the character line can be made to divert from its usual straight form by diversified stacking.
10. Most spring sizes available from stock.

For Descriptive Literature Write **KARL A. NEISE, Dept. TP**
404 Fourth Avenue, New York 16, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 144E

3 WAY
Reciprocating — Rotary — Oscillating
Di-Profiler
TRADEMARK

Used with any standard flexible shaft machine—speeds up to 12M RPM.

The Di-Profiler is a new multiple action tool that (1) Reciprocates (2) Oscillates and (3) Rotates when used with the spindle attachment. Stroke is adjustable from 0" to ¼".

It files, hones, polishes, laps, chafes and saws materials ranging from carbide tools to soft materials. The only machine of its kind. **Write for full details and price list today.**

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CIRCLE INFORM-A-GRAM KEY NO. 144F

HOLD THAT WIRING with-
NyGrip* ALL NYLON CABLE CLIPS

*TM

Large Stock on Hand, Many Sizes and Types
Send For Full Information and Free Samples
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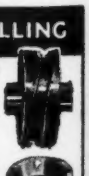
CIRCLE INFORM-A-GRAM KEY NO. 144G

EISLER **JIG** BORING **JOB** WELDING **CAM** MILLING

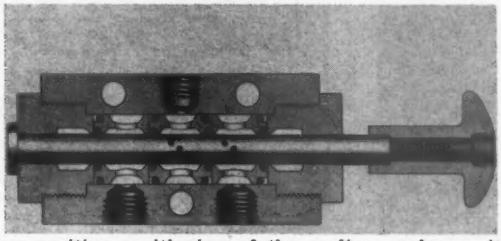
A SPECIALIZED CAM MILLING SERVICE... JIG BORING... SPOT WELDING... CONTRACT PRODUCTION ...EXPERIMENTAL DEVELOPMENT



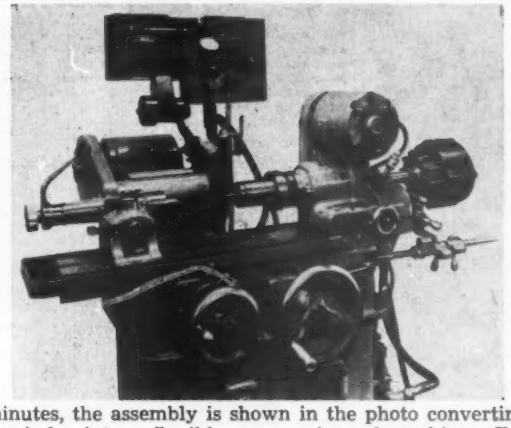
EISLER ENGINEERING CO., Inc.
732 So. 13th St. Newark 3, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 144H

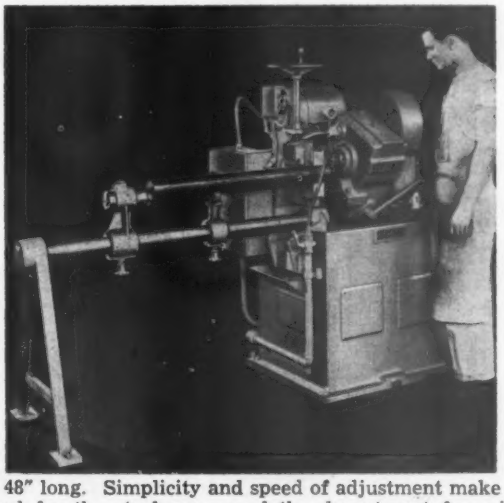
Hydraulic Control Valves. Friction and wear are minimized through the new interior construction features of Quick-As-Wink air and hydraulic control valves. The new interior design greatly simplifies the valve and assures positive positioning of the sealing packers without placing any mechanical pressure on the packers themselves. More complete details and descriptive literature can be obtained by writing C. B. Hunt & Son, Inc., Salem, Ohio or— **Circle Inform-A-Gram No. A28.**



This Wil-Numat Air Collet Closer gives your low-cost grinders more flexibility and adapts them quickly for 5C collets or their equivalent. Mounted in a matter of minutes, the assembly is shown in the photo converting a grinder into a flexible more universal machine. For additional information, contact the Wil-Numat Corp., 3713 S. Robertson Blvd., Culver City, Calif., or— **Circle Inform-A-Gram No. A29.**



This New Single End Milling & Centering Machine, manufactured by the Sundstrand Machine Tool Co., Rockford, Ill., handles work from ¾" to 3½" dia. x 5" to 48" long. Simplicity and speed of adjustment make it ideal for the steel room or lathe department for miscellaneous shaft work. Further information gladly furnished. **Circle Inform-A-Gram No. A30.**



WELDON

"TU-LIP" COUNTERBORES

for

FAST, FREE CUTTING

As the name implies, WELDON "Tu-Lip" counterbores have only two cutting lips or flutes. This feature, together with the fast spiral, makes the "Tu-Lip" the fastest, freest cutting counterbore on the market.

Breakage due to clogging is prevented because this improved cutting tool provides more than ample chip room. Furnished singly in sizes desired or in convenient wood block sets as illustrated.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

WRITE FOR LATEST CATALOG NO. 10.

THE WELDON TOOL CO. Cleveland 4, Ohio

3000 WOODHILL ROAD

CIRCLE INFORM-A-GRAM KEY NO. 145

3-D MAGNIFICATION
For Inspection and Small Assembly Work
with Bausch & Lomb Stereomicroscopes
Three dimensional vision
Unreversed image
Speeds work
Requires less skill
Call DoALL — consult yellow directory for nearest DoALL Service-Store that stocks cutting tools, gages, supplies—or Write
The DoALL Co.
Des Plaines, Ill.
Makes little parts look big!

CIRCLE INFORM-A-GRAM KEY NO. 146A

REICH 3-WAY
PRECISION TEST INDICATOR
For quick machine and tool work set-ups
Lifetime conical bearings, stainless and non-magnetic. Sturdy construction. Needs no service or adjustment. .014" reading.
Price $7.50 Write for folder
J. R. Reich Manufacturing Co.
45 E. Stroop Rd. Dayton, Ohio

CIRCLE INFORM-A-GRAM KEY NO. 146B

The Metals Handbook
1332 Large pages
1752 Illustrations
1057 Tables
803 Articles
1,620,000 Words
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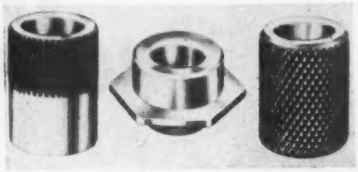
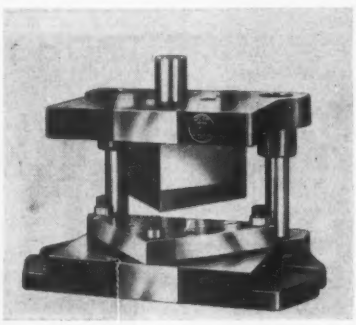
Drill Jig Bushings. These new drill bushings are made especially for use in fibreglas, wood and castable materials. For catalog and complete



technical data, write the manufacturer, American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 57, Calif.—or

Circle Inform-A-Gram No. A31.

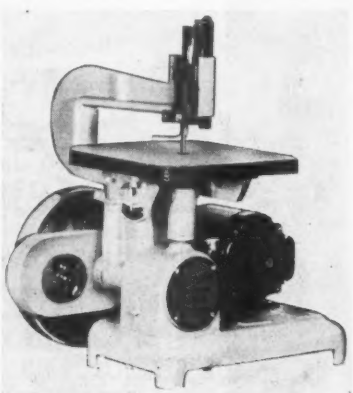
"V" Notching Arc-Fit. A precision tool for "V" notching angle iron to give a full 90° bend has just been announced by the Vogel Tool & Die Corp., 1807 N. 32nd Ave., Melrose



Park, Ill. The tool, consisting of punch, die and die set, will notch angles up to and including 3" x 3" x 3⅜" and flat stock of ⅜" thickness. Further information is available.

Circle Inform-A-Gram No. A32.

Cuts Tool & Die Making Costs. This compact, low-cost, bench-type Milwaukee die filer performs all sawing, filing, and lapping operations with accuracy and speed. It



can be used for finishing dies, templates and gages, and for sawing metal, rubber, fibre and plastics. Literature is available from the Rice Pump & Machine Co., Belgium, Wis.

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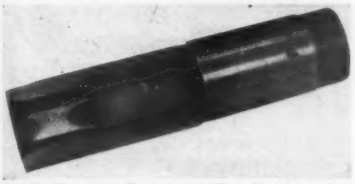
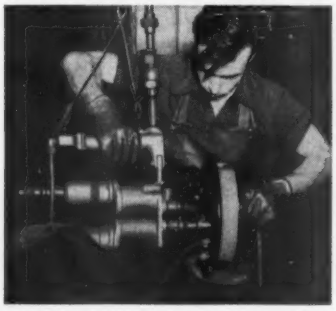
CIRCLE INFORM-A-GRAM KEY NO. 146H

New "Hex" Feed Finger. Balas Collet Mfg. Co., Cleveland 14, Ohio, announces a new improvement on all its two-split feed fingers designed for use with hexagon stock. The new



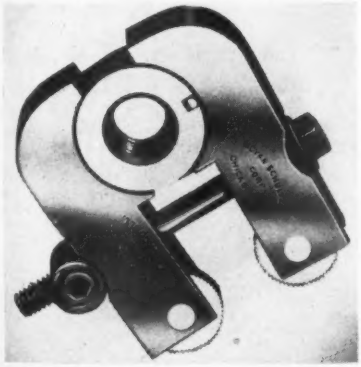
feed fingers have a "hex" chamfer in the back hole to enable the operator to be certain the stock is in line with the hex in the feed finger when loading stock. Full information is obtainable. **Circle No. A34.**

A Multiple Nut Setter that will set from two to five nuts simultaneously —each to an individual torque—has recently been announced by the Kel-



ler Tool Co., Grand Haven, Mich. The illustration shows a nut setter in use on an automobile assembly line —attaching the brake plate to the front spindle. Further information is available. **Inform-A-Gram No. A35.**

A Cross Slide Knurling & Thread Rolling Tool with floating, self-centering features that are designed to compensate for any center misalignment has been developed by the Boyar-Schultz Corp., 2110 Walnut



St., Chicago 12, Ill. Developed for single spindle automatics, this tool can be used on either front or rear cross slides. It also is adaptable to multiple hand screw machines and turret lathes. Additional information available upon request. **Circle Inform-A-Gram No. A36.**

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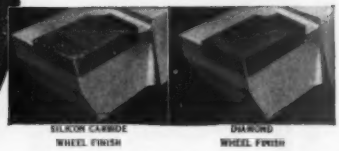

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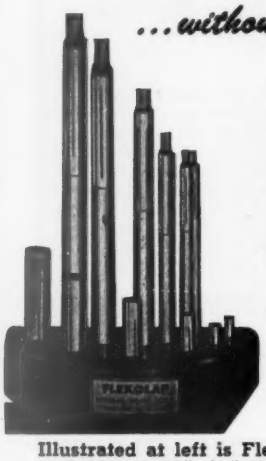

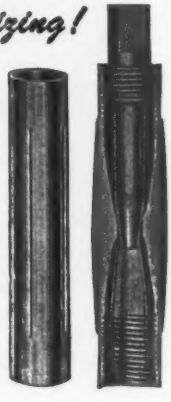

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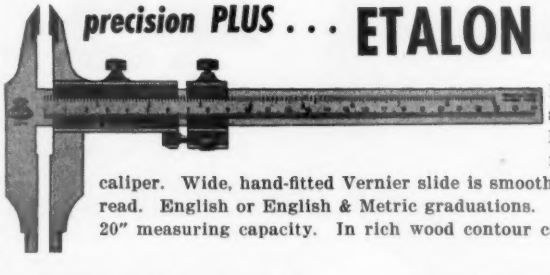

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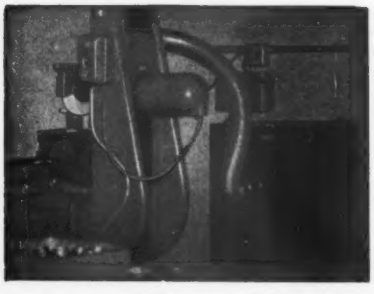

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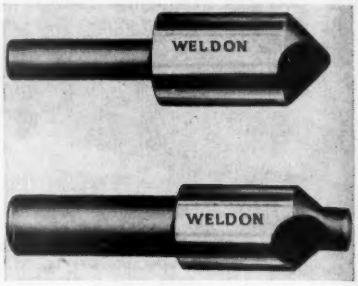
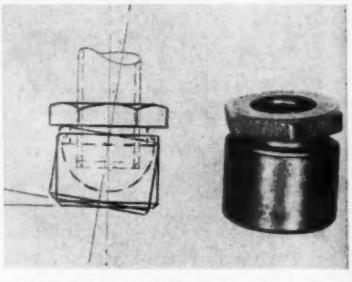
A New Type of Countersinks & Deburring Tools is the latest development of the Weldon Tool Co., 3000



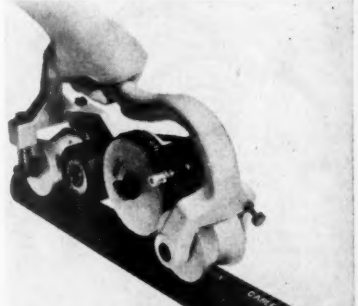
Woodhill Rd., Cleveland, Ohio. Greater ease in cutting, and a single cutting edge are advantages of this tool. Write for further information. **Circle Inform-A-Gram No. A37.**

Removable Clamp Shoe. This shoe is easy to attach and will fit a standard thread like an ordinary nut. It is designed to stand a great deal of pull, as well as pressure. The swivel



action of the shoe will allow it to follow the contour of the work it is clamping without marring the surface. For further information, write to the Lance Mfg. Co., 31144 W. 8 Mile Rd., Farmington, Mich. **Circle Inform-A-Gram No. A38.**

Portable Bar & Tube Printer. This new #230 Matthews portable printer, developed and manufactured by Jas. H. Matthews & Co., 3927 Forbes St.,



Pittsburgh, Pa., can be used for continuous printing of tradenames, codes, inspection marks, etc., on flat, round, square or hexagonal surfaces. Further information is available. **Circle Inform-A-Gram No. A39.**

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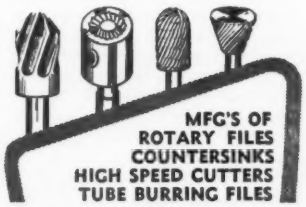

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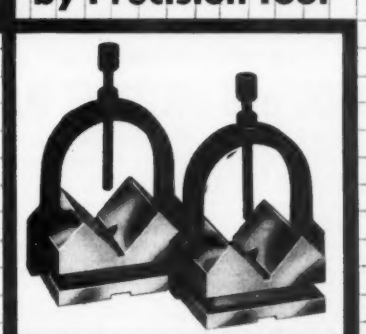

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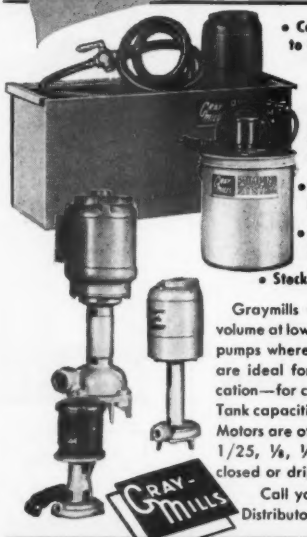

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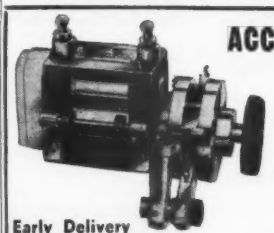

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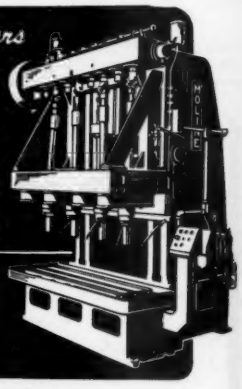

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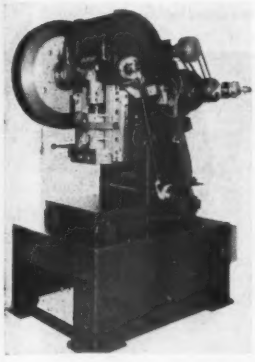
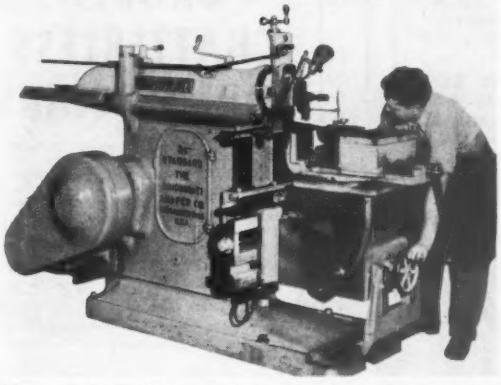


A 50-ton High Speed Automatic Stamping Press with a new "Revertomatic" adjustable speed drive which permits clutching at low speed and building up to a predetermined high speed at an adjustable rate has been introduced by the Precision Welder & Flexopress Corp., Cincinnati 10, Ohio. Complete information on other new features of this machine, plus specifications is offered by the manufacturer. **Circle No. A40.**

Here Is a 24" Standard Cincinnati Shaper, equipped with a special tilting table, that positions the work quickly and accurately enough to hold setup time to a minimum. The machine is used in the manufacture of glass



molds and is instrumental in keeping metal removal down and increasing the life of the glass mold. Detailed information is available from The Cincinnati Shaper Co., Hopple, Garrard & Elam Sts., Cincinnati 25, Ohio. **Circle Inform-A-Gram No. A41.**

For Substantial savings in grinding parts having multiple diameters, such as transmission and motor shafts, the Norton Co., Worcester, Mass., has come up with a new type CM-1 heavy duty semi-automatic multi-wheel

grinder. Besides the advantages of minimizing operating duties, consistency in the high output rate is practically assured because the machine performs all grinding operations within a predetermined time. Of course, further information is available. **Circle No. A42.**

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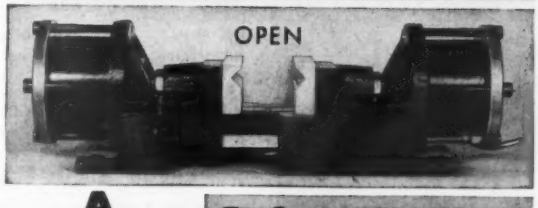

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designed to locate centers or other pre-determined points regardless of shape or varying sizes of parts within .001" horizontally or vertically.

Vise jaws travel on guides – actuated by opposed double-acting cylinders–synchronized by mechanical means. Force exerted is all straight line. Clamping pressures up to 2000 pounds. No pressure exerted through synchronizing mechanism. Working range 0 to 4". For centering, drilling, chamfering, hollow milling, deburring, reaming and many other production operations.

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Size 6" No. 22B, Graduation 1/40", vernier reading .001.

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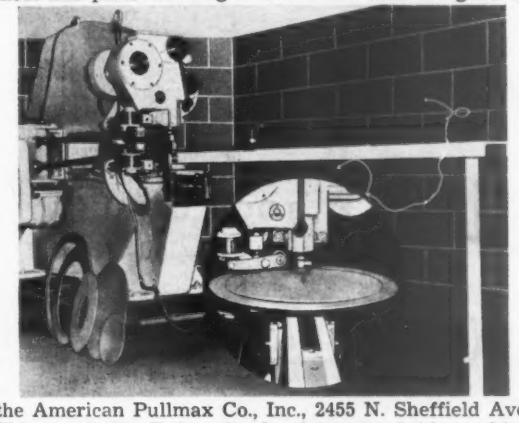
Chip Protection Without Visibility Loss is afforded by the Dilley magnetic grip-shield, a convenient composite of Alnico permanent magnet and special tru-vision plas-

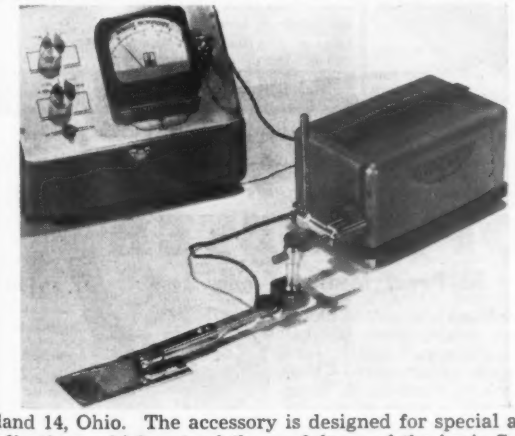
tic shield. This device mounts immediately in any position on any machine. It is fully described in latest literature available from the Dilley Mfg. Co., 1656 Ansel Rd., Cleveland 6, Ohio. **Circle Inform-A-Gram No. A43.**

An Outside Attachment with a sliding center which increases the radius capacity for cutting circles with a sheet and plate working machine has been designed by



the American Pullmax Co., Inc., 2455 N. Sheffield Ave., Chicago 14, Ill. Before the development of this machine, the diameter of circles was restricted to the throat depth of the machine. **Circle Inform-A-Gram No. A44.**

A Mechanical Tracing Accessory for use with the Surfindicator, an instrument for measuring surface roughness, is now available from the Brush Electronics Co., Equipment Division SP, 3405 Perkins Ave., Cleve-



land 14, Ohio. The accessory is designed for special applications which extend the usefulness of the basic Surfindicator beyond the range that is practical with hand operation. A detailed description of this unit is available. **Circle Inform-A-Gram No. A45.**

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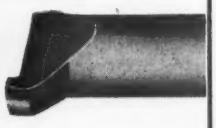

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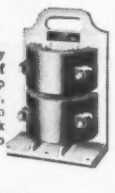

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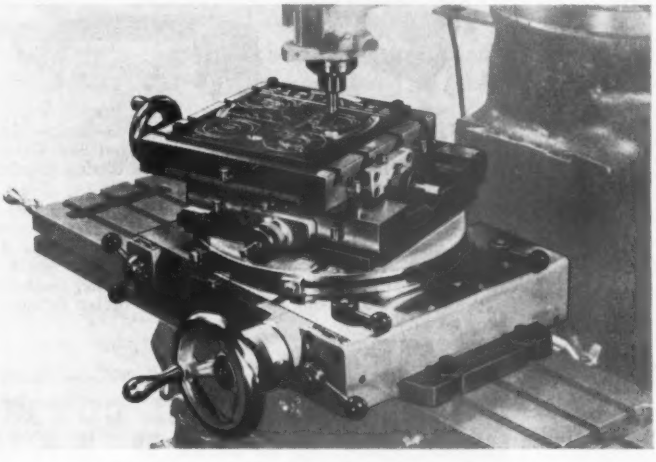
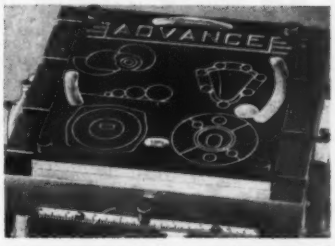
The great variety of vertical milling operations called for in the manufacture of dies, molds, templates, patterns, tools and fixtures can be greatly expedited and simplified when done on an auxiliary milling table which offers two 90-degree coordinate motions plus 360 degrees of rotary movement. The versatility of these work-feeding movements are of equal value in short run production, experimental and model work.



Every cutting path or profile called for is translated into terms of measured table travel simply by reference to the drawing which details the workpiece. As a result setup time may be cut from 50% on simple jobs to as much as 90%, on more intricate jobs.

In actual use the workpiece is located and clamped on the 11 inch square top across slide, and is not released until all work has been completed — regardless of the number of operations, radii, angles, etc. to be cut. Positioning of the workpiece from any point to another is accomplished accurately in a matter of seconds, thereby saving conventional setup time. The cross slides may be adjusted to position work for cutting any radius whose center lies within an 8-inch square working area of the table top. Table travel stops are provided so standard gage blocks can be used for extremely precise positioning and lengths of cut. Shown in the small photograph is a sample workpiece on which there are over fifty different radii, in addition to all the angular cuts, which were milled with work retained in its original positioning on the cross slide.

The rotating portion of the table may be turned by a worm shaft hand wheel, the collar of which is graduated in minutes.



This worm shaft may be quickly disengaged, allowing the table to be turned freely by hand as an aid in locating the workpiece. A non-influencing, expansion type brake and lock serves to hold the table or as a back lash eliminator for climb cuts, and is conveniently located to the left on the front of the table base. Angular stops are provided, which can be clamped at any point on the periphery of the rotating member, rotation being stopped by contact against a positive stop block which swings out of the way when not needed.

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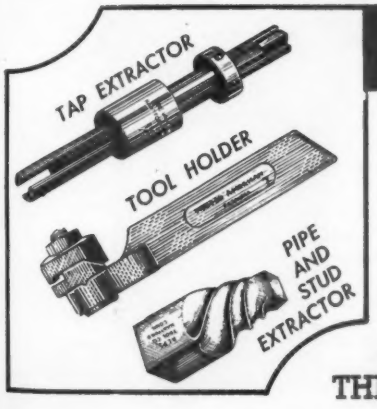
The "Advance" rotary type tool and die table is 9 inches high overall, 20½ inches wide at base, 18¾" deep (less hand wheel), and weighs approx. 325 lbs.

Inform-A-Gram Key No. D1.



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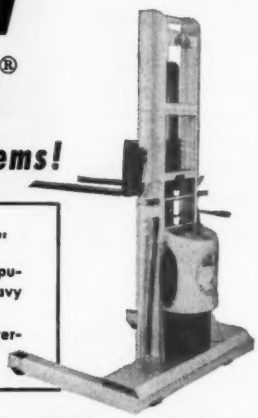

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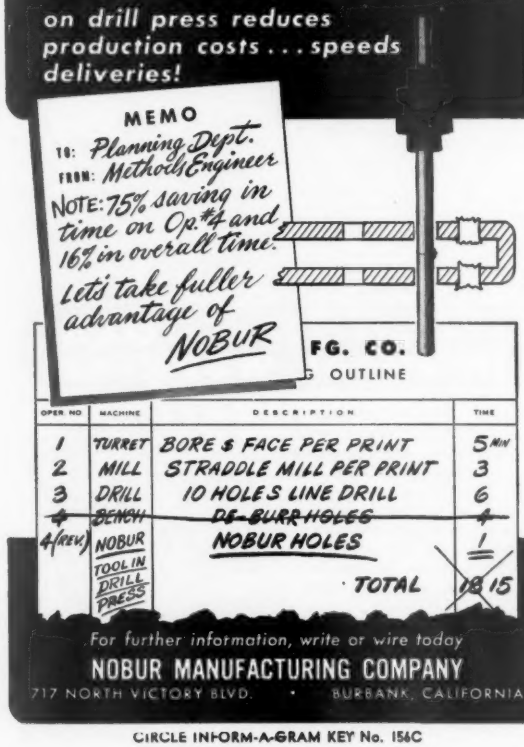
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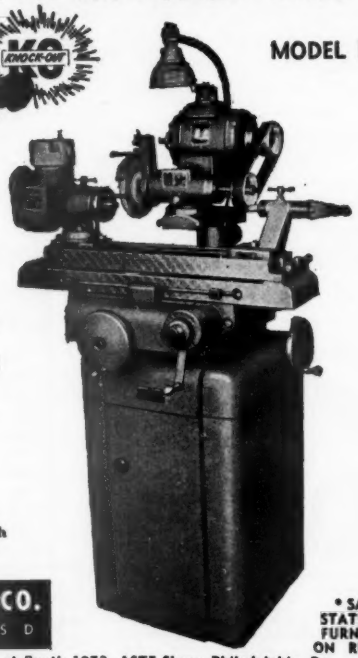

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CIRCLE INFORM-A-GRAM KEY No. 156D

. . . Press Production, from page 72

abuts the punches D, mounted in the side rams E. Further movement of the ram compresses the workholder springs so that the component is securely held, and imparts an inward movement to the punches by the action of the cam-plates F. The slugs from the notching operation are forced into the central hole of the spigot B, whence they fall away.

During the return movement of the ram, the cam-plates F withdraw the punches, and the workpiece is ejected by the upward movement of the sleeve C. A spring-loaded ejector frees the component from the workholder, and the plunger G retains the component in position until it is transferred to the last tool station.

A final sizing operation on the seating and notches is performed by the tool at station 14. A fixed workholder in the upper tool, similar to that at C, Figure 8, forces the component downwards over a punch in the lower tool. A transverse tongue, fitted to this punch, sizes the notches, any burrs thereon being "ironed" back into the component. The pressure sleeve in the lower tool, which supports the shoulder of the component, is fitted with a spring cushion, since an air-cushion in not available at this station. After the sizing operation, the side-lamp body is delivered by transfer mechanism to the unloading position of the machine.

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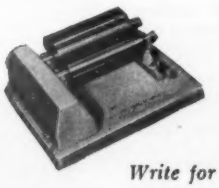

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Huot is pronounced "How-ot"

CIRCLE INFORM-A-GRAM KEY NO. 158D

Tool Steel Veteran Named Sales Head

With a background ideally suited to dealing with the tool steel industry, William J. Linhart takes over the sales manager position at Darwin & Milner, Inc., inventors and pioneers of PRK and NEOR tool steels. The new executive had been a sales engineer at the Cleveland, Ohio firm for the past five years. Previous to that he held a supervisory position with the Ferrotherm Co. Linhart served his apprenticeship in the metalworking field as a tool maker and heat treater for the Westinghouse Corp. His wide experience in tool steel is expected to be a tremendous asset for both Darwin & Milner and customers alike.

William J. Linhart

Elect New Officers at Tool & Die Institute Meeting

Don E. Sutton, president of the Northern Tool & Die Co. was elected president of the Tool & Die Institute at the group's annual meeting. He succeeds V. A. "Vince" Weiland, who was presented with a handsome Award of Merit plaque as a tribute to his outstanding service to T & D I as president the past year.

Harry C. Faust, president of the Paragon Spring Co., was named vice-president; and Evert Sund, executive vice-president and secretary of the Ideal Tool & Mfg. Co. was made treasurer.

Three new directors also were elected for a term of three years, and John Press was re-elected as a director for a like term. The new directors are: Rolf H. Berg, Atols & Son Tool & Die Works; Herbert Harig, Harig Mfg. Co.; and Walter Krieger, Three Star Mfg. Co. Retiring directors were: Wallace E. Carroll, Warren A. Peterson, and Thos. C. Roberts.

Tom Roberts completes six consecutive years on the board, during which time he served as vice-president and president respectively. Wallace Carroll also completes a second, three year term on the board, serving as vice-president and president.

PRECISE hole location, easy contour inspection with *new* machine tool microscope

Any machine shop, large or small, can save time and money on milling and boring work with the new Perkin-Elmer Model 11 Machine Tool Microscope. For hole location, its wide field of view (¼") or 30x magnification makes it possible to gage accurately to a ten thousandth—*at a glance.*

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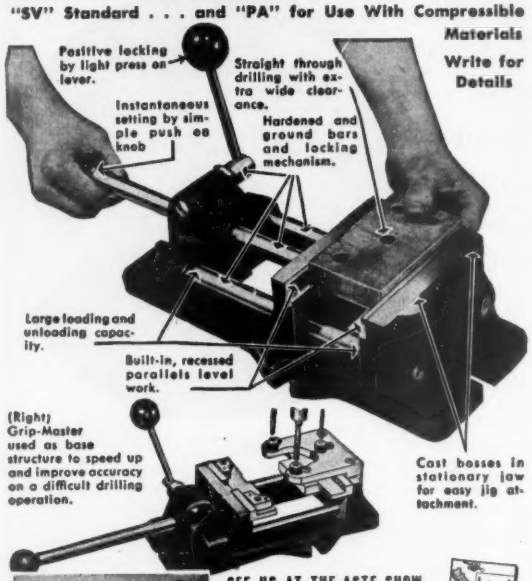
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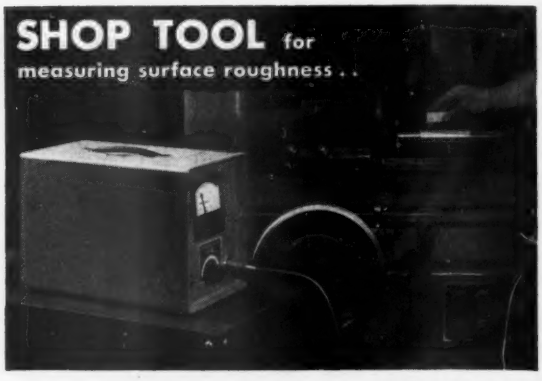

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. . . Which To Use, from page 53

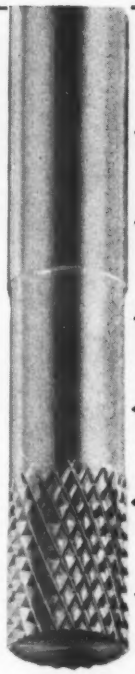
Because of the widely divergent groups of application made possible by improved powder metallurgy technology, improved machine tool design, application know-how, and other advancements, the afore discussion relates principally to cutting tools, although many other applications may require similar consideration.

To further aid in the selection of shank materials, the chart in Figure 7 indicates a few general recommendations for cutting tool shank materials although the individual requirement must be tailored to suit.

APPLICATION	SUGGESTED SUPPORT MATERIAL
Single Point	
—Brazed Type	SAE 1060 to 1095
—Mech. Held	0.050 to 0.060 Carbon Nickel-Chromium —0.050 to 0.060 Carbon Manganese —0.050 to 0.060 Carbon
Milling Cutter Bodies	
—Insert Type	Nickel Alloy Forging —0.030 to 0.040 Carbon
—Brazed Type	Non-Deforming Tool Steel SAE 1095
Planer Tools	Nickel-Manganese, Med. Carbon H. S. S.
Taps	Med. Carbon-Nickel SAE 1095
Drills	Manganese—Med. Carbon SAE 1060 to 1095
Circular Form Tools	Non-Deforming Tool Steel SAE 1095
Dovetail Form Tools	Med. Carbon-Nickel SAE 1095
Percussion Applications	Med. Carbon-Manganese Nickel Forging

Fig. 7. General recommendations of support materials for various types of carbide cutting tools.

From the text it can be easily realized that the matter of tool support material is a subject of considerable importance and should not be treated lightly. The best recommendation that the writer can make with regard to material selection is "analyze the individual case thoroughly, make a choice, then consult your plant metallurgist, tool shank material supplier, and the carbide supplier" to determine whether or not your selection agrees with their recommendation. If all three agree, it is a pretty sure bet that your choice has been a wise one.



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Yes, in only one-fourth the production time required by use of mounted points, FORD solid carbide grinding burs will remove material hardened up to 68 RC. Save down time, tool cost. Ford carbide burs can be resharpened many times and still retain new-tool accuracy. Let us prove it. Write today.

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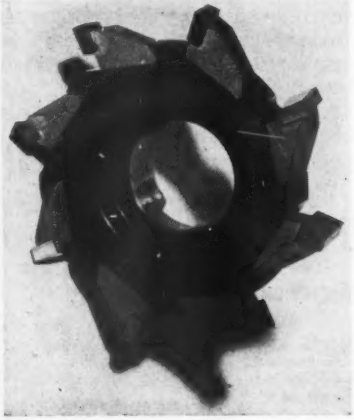
Millet Introduces Shell & Face Mills

Shell end mills from four to eight inches in diameter and face mills from eight to 14 inches in diameter are now available with the patented Millit replaceable blade. The Millit blade design



features maximum tooth back-up that makes possible a replaceable blade cutter with the same full tooth rigid characteristics as solid body brazed on tip shell mills and face mills.

Further information can be obtained from Millit, Inc., 49 Flint Street, Rochester 8, New York. **Inform-A-Gram Key No. D2.**

Sperry Offers Film On Ultrasonic Test

"Ultrasonic Inspection", a ten-minute sound-color educational film describing the development, theory, operation and application of the Sperry Ultrasonic Reflectoscope for non-destructive testing of metals and other materials, has just been released by Sperry Products, Inc., of Danbury, Connecticut.

Latest techniques in ultrasonic testing of raw stock, finished parts and plant equipment are illustrated with scenes taken in Sperry's research laboratories and customers' plants. Included are excerpts from a Heppenstall Steel Company film on ultrasonic inspection of die blocks, and from a Wyman-Gordon film on ultrasonic inspection, at various stages of fabrication, of highly stressed parts for supersonic aircraft.

Prints of the film are available for showings to interested industry, trade and technical groups as well as technical and engineering societies, schools and colleges.

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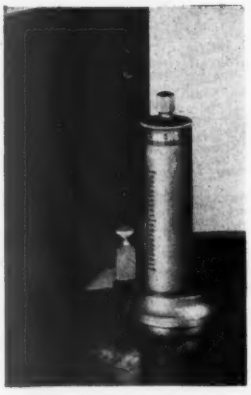
The plastic cutting operation is run at 3600 rpm with a 14 or 16-inch circular saw. The 14-inch saw has 90 Carboloy carbide teeth, the 16-inch has 96. The plastic comes in varying thicknesses, and on other sizes, the differential between cutting abilities of high speed steel and carbide is even more pronounced.

On the ¾-inch material, for example, 6 feet of material is the upper limit that can be cut with steel. Over 10,000 feet can be run with carbides. This applies to most plastic compounds. On heavy compounds like 113, the carbide cuts 4000 feet. But when using a new machine that also cuts aluminum, the department averages over 10,000 feet per grind with carbides even on the heavy compounds.



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. . . Noise Problems, from page 118

acoustical treatment is not applicable or adequate, and have many other uses in the reduction of noise, such as perimeter treatment.

Developed after years of research in cooperation with leading acoustical consultants and

Photo courtesy Sonosorber Corp.

A sound solution to the industrial noise problem by over-all use of Sonosorbers, new devices that are small, light-weight and economical. In the photo they are hung on 4′ centers, but they also may be suspended on 2′-4′-6′ and 8′ centers and may be used as over-all treatment in clusters or honeycomb patterns or as desired.

engineers, these sound absorbing units have high value of noise absorption in both high and low frequencies. They are described as volume absorbers, with absorbtion areas larger than their physical dimensions in certain frequencies. Being placed in the intense sound area, their physical structure tends to break up sound waves, attract and absorb or drain the sound due to diffraction.

Sonosorbers are about 24″ long and are hung on 2′-4′-6′ or 8′ centers or as desired. They may be used in clusters of honeycomb patterns, or even in layers of groups over and near the source of sound. A sound shield or screen of Sonosorbers may be hung in one or more layers to isolate noisy locations.

Their use does not necessitate alteration or moving of sprinklers, lighting fixtures, skylight, ventilating or other existing equipment. They are non-flammable and have no adverse effect on fire insurance rates.

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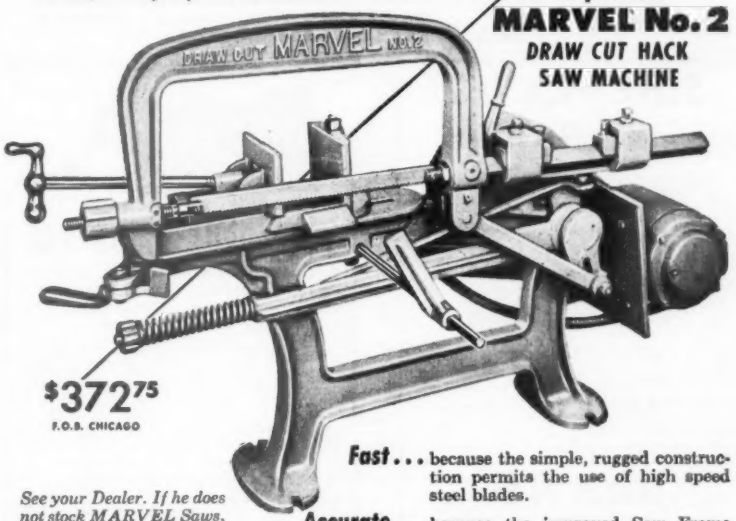

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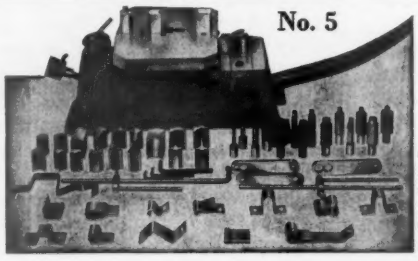

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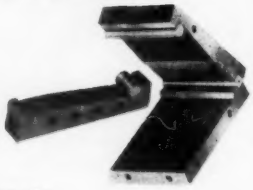
For precision fitting, checking clearances, inspection and production work. Available in 12" strips, ½" wide, in cellophane, packed 12 pieces of one thickness to a box; also in 25-foot coils. 14 standard thicknesses from .0015" to .015".

DESTACO DETROIT STAMPING COMPANY

344 MIDLAND AVENUE • DETROIT 3, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 166B

SINE PLATES and BARS



5" and 10"

HIGH GRADE ALLOY STEEL NORMALIZED FINISH GROUND AND LAPPED

Information and prices on request

BRAND TOOL & SUPPLY CO.

907 S. Victory Blvd. Burbank, Calif.

CIRCLE INFORM-A-GRAM KEY NO. 166C

YOST DRILL PRESS VISE

● This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

OFFERED IN TWO SIZES

Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	4	12½
2D	5	5½	23

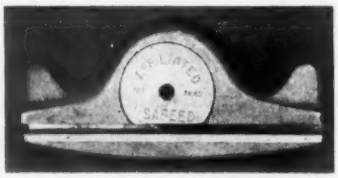
Do you need a vise of ANY type?
Write today for bulletin on the extensive Yost line

YOST MFG. COMPANY
1000 MAIN STREET
Meadville • Pennsylvania

CIRCLE INFORM-A-GRAM KEY NO. 166D

Every Punch Press Operator Needs the "Safety" of a SAFEED Patented

PREVENTS INJURY — SAVES GLOVE COSTS



Feeds ferrous, non-ferrous strip or sheet . . . faster, safer. Use for stamping, shearing. Right or left hand non-slip fitted grip, self-adjusting. Sturdy, hardened work surfaces. FULLY GUARANTEED.

Write today
Early delivery.

DEPT. T6 AFFILIATED MACHINE & TOOL CO.

260 WEST ST., NEW YORK 13, N. Y. CAnal 6-4937

CIRCLE INFORM-A-GRAM KEY NO. 166E

USE "INFORM-A-GRAM" FOR YOUR REQUEST, PAGE 131

LINDERME 2-SPINDLE ADJUSTABLE DRILLING HEAD

Drills, taps metal, wood, plastics. 2-minute setup on most drill presses; quick, accurate adjustment. Variety of models, ½" to 12⅝" centers.

The drill spindles are held rigidly in position when two nuts are tightened. Sturdily constructed. Suitable for adaptation to large or small drill presses. Models A and B made with sleeve. Models C and D with overarm adaptation, equipped with guide pins, springs and brackets, mounted to a cast-iron base with surfaces ground for use of drill fixtures. All models can be used for drilling or tapping on tapping machine or drill press with reversible spindle. Also used with standard tapping heads.

Multiple heads with fixed center distances are designed and built to meet your requirements. Available with GM Sleeves, Morse taper or drill chucks.

Write for full information

LINDERME ENGINEERING & SALES

8132 PURITAN DETROIT 38, MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 166F

For Defense

U. S. SAVINGS BONDS

ONE SOURCE-

Assures uniformity and precision between taps and chasers from country's largest independent manufacturer of die heads, chasers (milled, ground thread or tapped form) solid and solid, adjustable taps. All tangent type chaser threads ground from solid. Write for catalog.

PROMPT DELIVERY

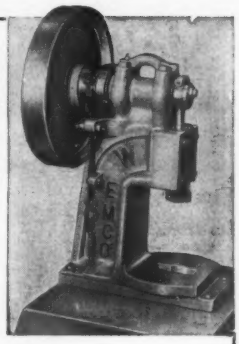
Save 10-20% on special solid taps

CHASO-ROYCO TOOL CO. INC.

P. O. Box 268 at Akers
North Branch, Michigan

Representatives in principal cities

CIRCLE INFORM-A-GRAM KEY NO. 166G



Emco "W", 5-ton, bench type; also larger Emco "X", 10-ton. Both sizes also stand-mounted. With or without motor drive.

EMCO

Power Punch Presses Are Speedy and Safe

Versatile Emco presses excel for punching, forming, stenciling and riveting metal, leather, plastics and other non-metallic materials. Up to 300 operations per minute. "Big machine" speed, strength, rigidity, accuracy, endurance. Compact, fool-proof; simple design—easy to operate. Thousands of Emcos in money-making use testify to Klaas dependability since 1921. Two practical sizes:

★ ★ ★

Ask for our Bulletin "T-3".

★ ★ ★

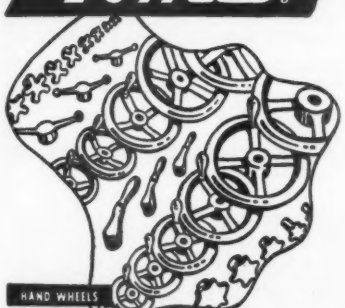
KLAAS MACHINE & MFG. CO.

4314 East 49th St., Cleveland 25

— KLAAS BUILT —

CIRCLE INFORM-A-GRAM KEY NO. 167A

Tomco



HAND WHEELS
HAND KNOBS
MACHINE HANDLES
HANDLES
BALL HANDLES
SPECIALTIES

Specify Tomco for long lasting dependability

A complete line of high grade hand knobs, handles, and hand wheels is available from Tomco. Immediate shipments are made from stock of standard items. Specialty items are made to your specifications.

For original equipment or replacement parts look to Tomco for quality and service.

Write for literature

Tomco PRODUCTS CO.

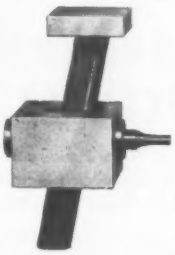
1623 DOUGLAS AVE.
RACINE, WISCONSIN

Blank or Machined - from stock

CIRCLE INFORM-A-GRAM KEY NO. 167D

SAVE TIME - COST

on Cam Dies



with

OCTOCAM

(pat. pend.)

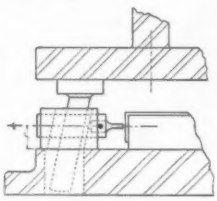
only $32.50

Immediate Delivery

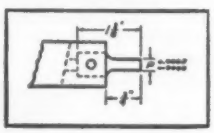
OCTOCAM pays for itself through savings in toolmaking time.

Barrel travel-3/16" per inch of press stroke.

All parts hardened and precision ground — assuring rigidity, accuracy and long life.



Punches available from 1/16" to 1/2" in any decimal size required. Only 90c each.



Add 60% for H. C., H. Cr. Steel. Other than listed sizes provided at additional cost.

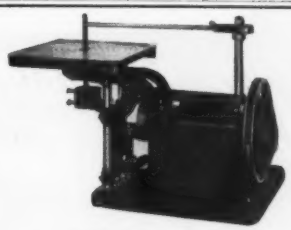
Write for Descriptive Bulletin

Distributor Inquiries Invited

Octavia Tool & Gage Co.

3320 N. Kedzie Ave. — Chicago 18, Ill.
Telephone: COrnelia 7-6695

CIRCLE INFORM-A-GRAM KEY NO. 167B



REGULAR SETUP

Note deep throat—13" if required.

FAST-ACCURATE DIE FILING

***Super* Die Filing Machine**

MADE SINCE 1930

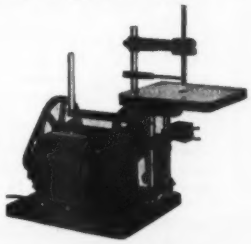
- Takes any shape, kind or brand of files from a 3" needle to a 1/4 x 1 x 12 file.
- File Support Rod moves with the file. Can be instantly pushed aside to remove or replace die.
- Fully guaranteed for 5 years against any mechanical defects.

IMMEDIATE DELIVERY

Direct to You From Factory

SETUP FOR OVERHEAD FILING

A 5-minute change. For filing blind holes, flanged punches, etc. Stroke adjustable down to 3/8" for filing shallow holes.



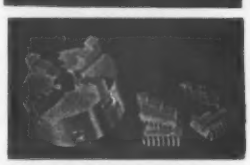
SEND FOR FOLDER

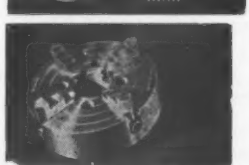
O. W. MOORE MACHINE CO.

TELEPHONE: SEeley 3-3696
2128 West Van Buren St.—Chicago 12, Ill.

CIRCLE INFORM-A-GRAM KEY NO. 167C

IMMEDIATE DELIVERY FROM STOCK • PRECISION BUILT • MADE IN ENGLAND





BURNERD CHUCKS *with UNBREAKABLE MEEHANITE BODY*

NOW AVAILABLE FITTED WITH THREADED BACK-PLATE TO FIT STANDARD AMERICAN LATHES

SELF CENTERING GEARED SCROLL

Nickel Chrome Steel Pinions & Scroll, Semi-Steel Body, Universal Three Jaw, Two Sets of Jaws, Three Pinion.

Model	Size	Weight (lbs.)	Bore (Chuck)	Thread (Backplate)	Price
30BP	4"	8¼	1	1½-8	$33.50
30ABP	5"	15	1½	1½-8	42.50
30ABP-2	5"	15	1½	2¼-8	45.00
31BP	6"	21	1⅞	1½-8	50.00
31BP-2	6"	21	1⅞	2¼-8	52.50
52BP-2	7½"	33½	2	2¼-8	65.00

Universal Four Jaw, Two Sets of Jaws, Two Pinions

Model	Size	Weight (lbs.)	Bore (Chuck)	Thread (Backplate)	Price
30AYBP	5"	15¾	1½	1½-8	$48.50
31YBP	6"	22	1⅞	1½-8	57.50
31YBP-2	6"	22	1⅞	2¼-8	60.00
52YBP-2	7½"	33½	2	2¼-8	92.50

LIGHT INDEPENDENT CHUCKS

Nickel Steel Operating Screws, Semi-Steel Body, Four Jaw Reversible, Hard Steel Jaws

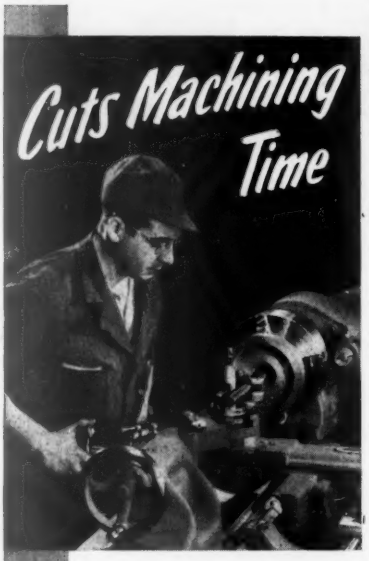
Model	Size	Weight (lbs.)	Bore (Chuck)	Thread (Backplate)	Price
35BP	4"	6½	1	1½-8	$18.00
35CBP	4½"	7	1	1½-8	22.50
34BP	6"	14	1⅝	1½-8	26.50
34BP-2	6"	14	1⅝	2¼-8	28.50
37BP-2	8"	22	1⅝	2¼-8	38.50

When ordering please specify make of lathe to insure exact fit

DE WITT EQUIPMENT CORP.

136 Lafayette St., New York 13, N. Y.
Telephone: WA 5-4048

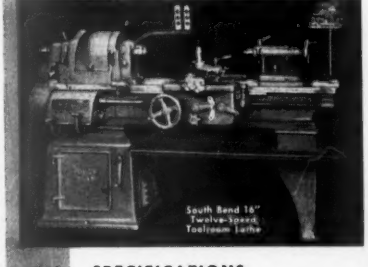
CIRCLE INFORM-A-GRAM KEY NO. 167E



SOUTH BEND
12-SPEED LATHE

The wide range of spindle speeds on this new lathe cuts machining time because the operator quickly selects the right speed for each operation. Pushbutton control provides a fast change from any high speed to the corresponding low speed. Its 48 longitudinal and cross feeds assure maximum efficiency on every job **$2690.00** F.O.B. Factory

CL-8155C—as illustrated below, less motor and controls. Time terms: 10% down, balance in 12 or 18 months.



SPECIFICATIONS

Spindle Speeds (approx.) Direct: high range 300, 550, 945; low range 150, 278, 475. Back gear drive: high range 32, 70, 118; low range 20, 33, 60.
Spindle Bore — 1⅜".
Swing over bed — 16¼".
Swing over saddle cross slide — 9⅜".
Distance between centers — 33¼", 45¼", 57¼", 81¼", 105¼".
Collet Capacity — 1" maximum.
Thread Pitches—48, 4 to 224 per inch.

SOUTH BEND LATHE
SOUTH BEND 22, INDIANA
Building Better Tools Since 1906

SOUTH BEND LATHES

CIRCLE INFORM-A-GRAM KEY NO. 168A

BIG NEWS FOR CUTTING COSTS!!

DRIVING CENTER

For High Production Turning, Milling, and Cylindrical Grinding

• ELIMINATES NEED FOR DRIVING DOG

- Maximum runout .00019
- Machine need not be stopped while changing work piece.
- *Patented Principle*—Compensates for "irregularities" and "out of square" in ends of work pieces, thus allowing driving teeth to embed themselves in end of work piece *evenly* without slippage.
- Center proper is spring loaded—drives teeth forward when pressure is applied by means of tail stock center—teeth embed themselves in work piece.
- Available in Morse tapers 2 to 6 for turning and grinding—17/32 and up. Write for bulletin.

DISTRIBUTORS
Big Seller in Chicago
Nation-wide Distribution Wanted
Write—

ZE-HAWK MACHINE SPECIALTIES
3716-20 W. Montrose Avenue
Chicago 18, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 168B

HOW TO SAVE MONEY WITH GRC SMALL DIE CASTINGS

Technical data and information for designers and engineers, case histories, etc.
Write today for this bulletin.

GRIES REPRODUCER CORP.
World's foremost producer of small die castings
44 Second Street New Rochelle, N. Y.
Phone: New Rochelle 3-8600

CIRCLE INFORM-A-GRAM KEY NO. 168D

Buy DURANT

PRESS ROOM EQUIPMENT

WIRE STRAIGHTENERS
Takes round or flat wire and tubing. Rolls adjustable by means of socket set screw. For use with automatic Slide, Roll or Hitch Feeds. Units available with 5, 7, 9 or 11 grooved rolls.

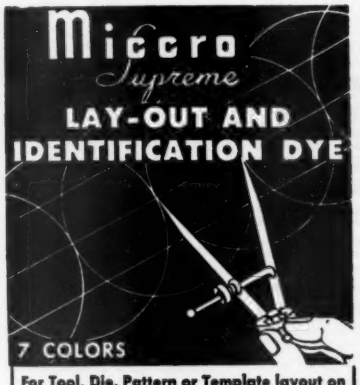
MOTOR DRIVEN STOCK STRAIGHTENERS
For all thin materials. Entering rolls power driven; top rolls are individually adjustable for stock thickness. Available in eight sizes.

SWEEP GUARDS
A positive safety guard on power presses. Easily installed. Downward motion of ram removes operator's hands. Rugged—withstands jarring impact of press. Needle bearings in guard housings assures long life.

Write Now for new catalog showing prices and complete line of Equipment.

DURANT Tool Supply Co.
136 SOUTH WATER STREET, PROVIDENCE 3, R. I.

CIRCLE INFORM-A-GRAM KEY NO. 168C



For Tool, Die, Pattern or Template layout on metal . . . Quick identification of bar stock, sheets, strips or parts . . . Shows up in sharp relief—dries instantly . . . Write for sample and circular on company letterhead.

MICHIGAN CHROME & CHEMICAL COMPANY
8615 Grinnell Ave. • Detroit 13, Mich.

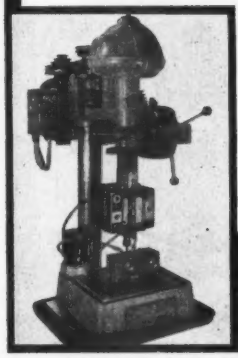
CIRCLE INFORM-A-GRAM KEY NO. 168E

Commander LEAD-MATIC Tapper

Automatic Tapper with Lead Screw
FOR HIGH PRODUCTION
PRECISION TAPPING

- Precision Ground Lead Screws Assure Finest Threads
- Electrically Controlled Cycle or Jog Tapping Action
- Hand, Foot or Fixture Switch Control
- Easily Adapted to Any Drill Press
- Range #0 to ¾"

Built for high production tapping . . . precision or otherwise, the Commander Lead-Matic Tapper makes any drill press a precision tapping unit, even with inexperienced operators. Electric control of Cycle or Jog tapping action provides versatility to handle any job . . . automatic tap reversal eliminates drill press motor reversing and speeds tapping. Compact, ruggedly built, easy to operate, the Commander Lead-Matic Tapper will cut your tapping costs and reduce rejects to a minimum.



Write for illustrated circular and name of nearest Distributor.

Commander MFG. CO.
4222 W. KINZIE ST. • CHICAGO
PRODUCT OF COMMANDER
BUILDER OF PRODUCTION TOOLS

See Us at Booth No. 823, A.S.T.E. Show, Philadelphia, Pa.
CIRCLE INFORM-A-GRAM KEY NO. 169A

Continuous Production on these new DURO

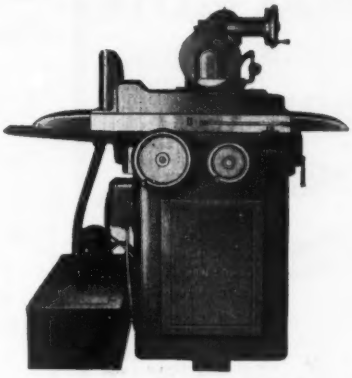
MULTI-SPINDLE DRILL PRESSES

Designed to satisfy industry's expanding need for faster, cost cutting production units these new 15½" Duro Multi-Spindle Drill Presses enable you to make your own efficient drill press combinations to fit your particular operation. 1, 2, 3 or 4 spindle set-ups give you the advantage of a continuous production line, eliminating costly transferring between machines and provides maximum working surface on long, heavy work. Precision machined, accurate — they incorporate the most modern features including: Ball bearings, 0 to ½" chuck capacity, 4¾" spindle travel; 9 splined spindle; Jacobs "safe-lock" Chuck; simple quill tension and wear compensating adjustment; double support motor mount; positive depth stop, adjustable depth gauge; built-in switches for light and power; plus many other features.

Write for FREE Brochure giving full details.

DURO METAL PRODUCTS CO. 2679 North Kildare Avenue Chicago 39, Illinois
World's Largest Manufacturers of Power and Hand Tools (Duro-Chrome)
CIRCLE INFORM-A-GRAM KEY NO. 169B

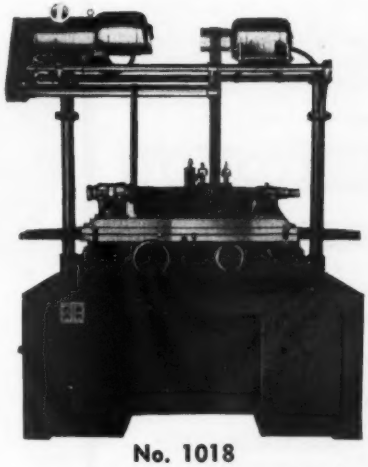
CARBIDE, STEEL, SAPPHIRE
MIRROR-FINISH GRINDING
to Close Tolerances



SURFACE GRINDER
Model No. 612

Grinds 6" x 12" — by 15" height over Standard chuck with 8" wheel.

Available with either Double Taper or Ball Bearing designed Spindles.



No. 1018
UNIVERSAL GRINDER

10" Swing, 18" Center Distance
10" Wheel — Cabinet Style Mounting

SEE THESE MACHINES AT BOOTH NO. 1427
A.S.T.E. SHOW — PHILADELPHIA
APRIL 26TH - 30TH

WRITE FOR LITERATURE

CRYSTAL LAKE GRINDERS
Since 1910
Crystal Lake, Illinois

CIRCLE INFORM-A-GRAM KEY NO. 169C

NEW
SPIRAL FLUTE
CARBIDE TIPPED
HARD STEEL
DRILL

SERIES 300

DIA.	DIA. OF BODY BACK OF CARBIDE	APPROX. LENGTH OF FLUTE	OVER ALL LENGTH	DIA. SHANK	APPROX R.P.M.	PRICE
1/16"	7/64"	1 1/2"	2 3/4"	1/8"	1000	$ 7.00
5/64"	9/64"	1 5/8"	3"	1/8"	800	8.50
1/8"	11/64"	2"	3 1/2"	1/8"	800	10.50
1/8"	11/64"	2 1/4"	3 1/2"	1/8"	700	13.50
3/16"	13/64"	2 1/2"	4"	1/8"	700	16.50
3/16"	13/64"	2 5/8"	4 1/2"	1/8"	600	19.50
1/4"	15/64"	2 1/2"	4 1/2"	1/4"	600	22.50
5/16"	17/64"	3 1/4"	5"	1/4"	500	25.50
5/16"	21/64"	3 1/2"	5 1/2"	1/4"	500	28.50
3/8"	21/64"	3 1/2"	5 1/2"	1/4"	400	31.50
3/8"	25/64"	3 1/2"	5 1/2"	1/4"	400	34.50
1/2"	31/64"	3 5/8"	5 3/4"	1/4"	450	37.50
1/2"	31/64"	4"	6 1/4"	1/4"	300	41.50
15/16"	15/16"	4 1/4"	6 5/8"	1/4"	200	45.50

Advantages: 1. Spiral flutes—better chip disposal. 2. Better support for carbide tip. 3. Self-centering point—no weaving. 4. Hardened H.S.S. body. 5. Drills without annealing. 6. Low cost construction.

STILL AVAILABLE

SERIES 100

Hardened steel drill. Solid carbide cutting end. Will not anneal. Holds size perfectly. No coolant required on shallow holes. Available in 10 sizes: 1/8" to 5/8" dia.

SERIES 200

Drills center in hardened steel in one operation. Cuts clean centers without annealing and without use of coolant. Available in 4 sizes: 3/32" to 9/32" (drill dia.).

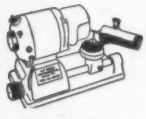
Write for data—Also our tool salvage catalog

NATIONAL TOOL SALVAGE CO.
6511 EPWORTH BOULEVARD
DETROIT 10 MICHIGAN

CIRCLE INFORM-A-GRAM KEY NO. 170A

ENGRAVING, ACID ETCHING, ELECTRIC MARKING—
all can be done in this
PREIS-*PANTO UE MACHINE
with simple attachments.

MODEL UE ENGRAVER
For metals, plastics and other materials. Electric marks or acid etches hardened steel.



Model CG CUTTER GRINDER
for single-lip Engraving & Routing Cutter Grinding.

***PANTO MASTER COPY TYPE**

carried in stock

CUTTERS and COLLETS
Single lip, straight or tapered.

PANTO

Write for literature.
Trade Mark
*Reg. U. S. Pat. Off.

H. P. PREIS ENGRAVING MACHINE CO.
647 U. S. Route 22, Hillside, N. J.

CIRCLE INFORM-A-GRAM KEY NO. 170B

DOES IT BETTER
DOES IT FASTER

SIMPLEX-M
ABRASIVE BAND GRINDER

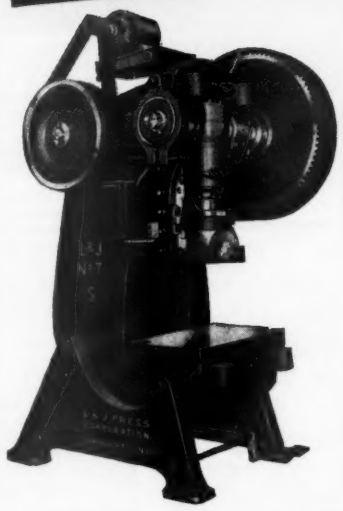
The precision of a machine tool plus the durability of a workhorse. Complete with 1/2 H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

WALLS SALES CORP.
333 Nassau Avenue, Brooklyn 22, N. Y.

CIRCLE INFORM-A-GRAM KEY NO. 170C

Improved
L&J PRESSES
Better-Built for Better Work



L&J Presses are producing work of better quality in larger volumes at reduced costs for numerous manufacturers. Here's why they do it:

- **Heavier, more rigid frames give minimum deflection for greater accuracy, longer die life at higher press speeds.**
- **Replaceable bronze bushings are standard equipment on two main and upper ram bearings.**
- **Roller bearings are standard in flywheel or main gear and backshaft mountings.**
- **Precision-scraped gibs of extra length for more permanent alignment and accuracy.**
- **Balanced designing plus precision manufacture for better performance and dependability.**

These are but a few of the reasons why L&J Presses can improve your press work and affect economies. 17 O.B.I. models—6 to 80 ton capacities—all available with air clutches. *Write for literature.*

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CIRCLE INFORM-A-GRAM KEY NO. 170D

"M-B" JUNIOR
75,000 RPM Pneumatic GRINDER

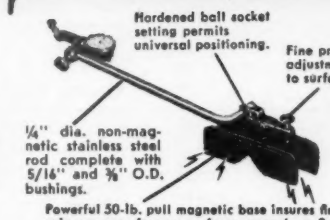
4 TYPES—2 lengths of spindle extension; 2 types of air control valves, one for continual operation and one for intermittent work. Steel body for safety. No lubrication required. Abundance of power. Light-weight 12 ounces. Whole length 5⅜", length of body 3". Accommodates mounted grinding wheels, rotary files, etc. on ⅛" dia. shanks. Speed such as to operate Tungsten Carbide burrs, rotary files, etc. to their full efficiency. "Remember, Built-in Quality Remains Long After First-Cost disappears."

Visit our Booth No. 1439, at A.S.T.E. Show, Philadelphia, April 26th to 30th

M·B PRODUCTS
46 Victor Ave.
DETROIT 3, MICHIGAN

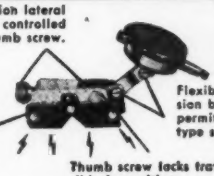
CIRCLE INFORM-A-GRAM KEY NO. 171A

CUT INDICATING TIME with MAGNA-HOLDER Indicator BASES


Hardened ball socket setting permits universal positioning.
Fine precision adjustment identical to surface gauge.
¼" dia. non-magnetic stainless steel rod complete with 5/16" and ⅜" O.D. bushings.
Powerful 50-lb. pull magnetic base insures firm grip on any ferrous surfaces curved or flat.

FOR SMALL TEST INDICATORS Model 200B Price $5.45

TAKE SECONDS—NOT HOURS


Precision lateral adjustment controlled by thumb screw.
Accommodates all indicators with standard ¼" lug back.
POWERFUL 50-lb. pull magnetic base insures firm grip on any curved or flat ferrous surface.
Flexible extension brackets permit all type settings.
Thumb screw locks travel slide in position.

FOR LARGE TEST INDICATORS Model 350A Price $8.50

● Magna-Holders are produced by the Country's largest exclusive manufacturer of magnetic base instruments and custom accessories including MAGNA-HOLDERS for floodlights, inspection lights, flashlights, safety shields, and magnifying glasses. If your dealer cannot supply—order direct giving name of dealer. Write Dept. 24-C.

CULLEN Mfg. Co.
1318 CLARK STREET
RACINE, WISCONSIN

CIRCLE INFORM-A-GRAM KEY NO. 171B

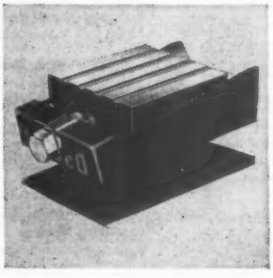
PERIODIC LEVELING IMPORTANT TO PEAK MACHINE EFFICIENCY!

Machine tool manufacturers emphasize the importance of not only setting machines level, but keeping them that way. It's a must where accurate work tolerances are involved, or, if you're trying to keep down machine maintenance costs.

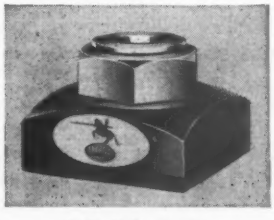
With EMPCO JACKS, setting machines level and keeping them that way is as simple as turning a screw . . . for that's all you do! Apply a wrench to the "hex" screw head and turn right or left until your level indicator reads "zero."

To reduce vibration, VI-SORB mounting pads are optional with each style EMPCO JACK. Mounting pads not only lessen the vibrations generated within the machine itself but also isolate it from the effects of vibrations in the building.

Each style EMPCO Leveling Jack is made in three sizes for light to heavy equipment and each size is available in many models suitable for various installations.



Style JD Wedge type



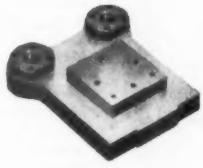
Style JS Screw type

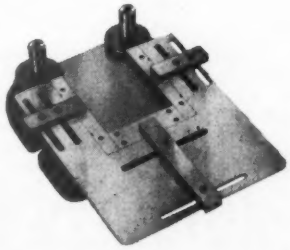
For complete specifications and prices, write the Enterprise Machine Parts Corporation, 2735 Jerome Ave., Detroit 12, Michigan.

CIRCLE INFORM-A-GRAM KEY NO. 171C

Punches and Dies

Notching Die with Gauge Table





Standard stock sizes 4", 5" and 6". Lick those Notching Problems QUICKLY. Gauge table and gauging bars provide accuracy and speed with easy adjustment.

This is another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Precision made from high grade tool steel. Also adaptors and die shoes to convert your press.

Immediate Delivery

What are your punch and die needs? Consult us about your problems. Prompt service on "Specials" made to your order.

Send for free illustrated catalog No. 154 AB. Net prices shown.

WARD Machinery Co. 564 West Washington Chicago 6

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ADVERTISERS INDEX

Abrasive Machine Tool Co. 12
Acme Industrial Co. 162
Affiliated Machine & Tool Co. 166
Aget-Detroit Co. 148
Alina Corp. 148
Allegheny Ludlum Steel Corp. 133
Allied Products Corp.
Richard Brothers Punch Div. 24
American Drill Bushings Co. 67
American Measuring Insts. Corp. 152
American Photocopy Equip. Co. 125
American Society of Tool Engrs., The 146
Armstrong Blum Mfg. Co. 165
Armstrong Bros. Tool Co. 98
Atlantic Gear Works, Inc. 152
Atlas Press Co. 85

Barth Corp., The 122
Basco Mfg. Co., The 154
Bath Co., The Cyril 69
Bausch & Lomb Optical Co. 86
Bearings, Inc. 66.1
Beaver Rotary File Co. 149
Beaver Tool & Engrg. Corp. 23
Bellows Co., The 3
Benco Collet Mfg. Co. 174
Big Joe Mfg. Co. 156
Black Drill Co., Inc. 151
Bloomfield Tool Corp. 149
Boyar-Schultz Corp. 164
Brand Tool & Supply Co. 166
Buck Tool Co. 105
Buckeye Tools Corp. 124

Carpenter Steel Co., The 150
Carter Products Co., Inc. 159
Challenge Machinery Co., The 136
Chandler Tool Co. 30
Chaso-Royco Tool Co., Inc. 166
Chicago-Latrobe 88
Cincinnati Grindors, Inc. 63
Cincinnati Shaper Co., The 6
Cleveland Grinding Machine Co., The 106
Clinton Machine Co.,
Metalmaster Division 139
Collins Co., H. G. 66.4
Colonial Bushings, Inc. 158
Columbia Tool Steel Co. 163
Comet Tool Co. 154
Commander Mfg. Co. ..... 123 & 169
Continental Tool Works
Div. of Ex-Cell-O Corp. 97
Crucible Steel Co. of America 34
Crystal Lake Grinders, Inc. 169
Cullen Mfg. Co. 171

Dake Engine Co. 101
Danly Machine Specialties, Inc. 22
Darwin & Milner, Inc. 73
Detroit Die Set Corp. ..... 82 & 83
Detroit Mold Engineering Co. ..... 137 & 157
Detroit Stamping Co. 166
Detroit Tap & Tool Co. 77
DeVlieg Microbore Co. 81
De Witt Equipment Corp. 167
Dickerman Mfg. Co., H. E. 108
Die Supply Co., The
Sub. of E. W. Bliss Co. 19
DoAll Co., The ..... 140, 142, 144 & 146
Drill Unit Div.,
Rockwell Mfg. Co. 89
Dumore Precision Tools,
The Dumore Co. 173
Durant Tool Supply Co. 168
Duro Metal Products Co. 169
Dykem Co., The 152

Efficient Tool & Die Co., The 85
Eisler Engineering Co., Inc. 144
Elgin National Watch Co. 27
Enco Mfg. Co. 126
Engis Equipment Co. 95
Enterprise Machine Parts Corp., The 171
Erickson Tool Co. 9
Ex-Cell-O Corp.,
Continental Tool Works Div. 97

Fairfield Gauge Co. 164
Falcon Tool Co., The 36
Famco Machine Co. 93
Federal Tool Corp. 148
Ford Mfg. Co., Inc., M. A. 161
Foster Supplies Co. 157
Froom & Co., R. H. 123

Gage Co. 151
Gorton Machine Co., George 87
Graymills Corp. 150
Gries Reproducer Corp. 168
Grobet File Co. of America, Inc. 152

Hamilton Tool Co., The ..... 114 & 115
Hammond Machinery Builders, Inc. 120
Handy Products ..... 18 & 80
Hardinge Brothers, Inc. 10
Harig Mfg. Corp. 39
Heimann Mfg. Co. 152
Heinrich Tools, Inc. 160
Hi-Shear Rivet Tool Co., The 134
Hovis Screwlock Co. 118
Huebner Publications, Inc. 78
Humm Safety Equipment Co. 146
Huot Mfg. Co. 158
Hutchinson Co., William T. 141

Index Machine Co. 96
Industrial Tectonics, Inc. 134

Jaco Devices, Inc. 138
Jelrus Precision Casting Corp. 150
Jergens Tool Specialty Co. ..... 66.3 & 153
Jones & Lamson Machine Co. 33

Kasson Die and Motor Corp. 140
Kearney & Trecker Corp.,
Special Machinery Div. 5
Klaas Machine & Mfg. Co. 167
Krasberg & Sons Mfg. Co., R. 154

Lakeside Steel Improvement Co., The 66.2
Last Word Sales Co. 118
Latrobe Steel Co. 15
Lavallee & Ide, Inc. 4
Lee Co., K. O. 156
Lehmann Boring Tool,
Div. Novo Engine Co. 111
Lempco Products, Inc. 100
Lepel High Frequency Labs., Inc. 8
Levin & Son, Inc., Louis 162
Lindorme Engineering & Sales 166
Littell Machine Co., F. J. 153
L & J Press Corp. 170
Logan Engineering Co. 21
Logansport Machine Co., Inc. 117
Longley Co., Truman E. 66.2
Lovejoy Flexible Coupling Co. 136

Marshall Steel Co. 121
M-B Products 171
Mead Specialties Co. 162
Melin Tool Co., Inc. 104
Metal Carbides Corp. 16
Metalmaster
Div. of Clinton Machine Co. 139
Meyers Co., Inc., W. F. 138
Michigan Chrome & Chemical Co. 168
Micrometrical Mfg. Co. 160
Mohawk Tools, Inc. 92
Moline Tool Co. 150
Moore Machine Co., O. W. 167
Moore Special Tool Co., Inc. ..... 32 & 149
Morton Machine Works 103
Motch & Merryweather
Machinery Co., Inc., The 142

National Instrument Co. 154
National Tool Salvage Co. 170
Neise, Karl A. 144
New Britain Machine Co., The 31
Nobur Mfg. Co. 156
Nord International Corp. 144
Northwestern 147
Norton Co. 107

Octavia Tool & Gage Co. 167
O. K. Tool Co. 146
Oliver Instrument Co. 140
O'Neil-Irwin Mfg. Co. 38
O-Vee Gauge Co. 152

Palmer-Shile Co. 163
Perfex Gage & Tool Co. 141
Perkin-Elmer Corp., The 159
Pope Machinery Corp. 25
Portage Double-Quick Tool Co. 102
Porter Precision Products 94
Pratt & Whitney
Div. Niles-Bement-Pond Co. ..... 74 & 75
Precision Tool & Mfg. Co. of Illinois 149
Preis Engraving Machine Co., H. P. 170
Procunier Safety Chuck Co. 123
Producto Machine Co., The 7
Putman Tool Co. 1

Reich Mfg. Co., J. R. 146
Reid Tool Supply Co. 149
Reliant Industries 126
Ren-ite Plastics, Inc. 123
Rice Pump & Machine Co. 142
Richard Brothers Punch Div.
Allied Products Corp. 24
Richards Co., J. A. 166
Rimat Tool Co. 154
Robbins Co., Omer E. 119
Rockwell Mfg. Co.,
Drill Unit Div. 89
Roll-Feeds Corp. 150
Rotor Tool Co., The 99

Sales Service Machine Tool Co. 26
Scherr Co., Inc.,
George ..... 134, 138, 144 & 149
Service Machine Co. 152
Severance Tool Industries, Inc. 146
Sheridan Products 141
Shore Instrument Mfg. Co., Inc. 146
Sibley Machine & Foundry Corp. 91
Sid Tool Co., Inc. 112
Siewek Tool Co. 90
Sindelar Co., G. F. 66.4
Small Lot Stamping Co. 144
South Bend Lathe Works 168
Spitfire Tool Co. 157
Standard Electrical Tool Co., The 128
Standard Parts Co. 130
Standard Pressed Steel Co. 29
Steel Products Engrg. Co., The 116
Super-Cut Distributors, Inc. 147
Superior Steel Products Corp. 11
Sutton Tool Co. 17

Tannewitz Works, The 136
Thermo Electric Mfg. Co. 158
Thornton Mechanical Laboratories 162
Tomco Products Co. 167
Tomkins-Johnson Co., The 110
Twentieth Century Mfg. Co. 126

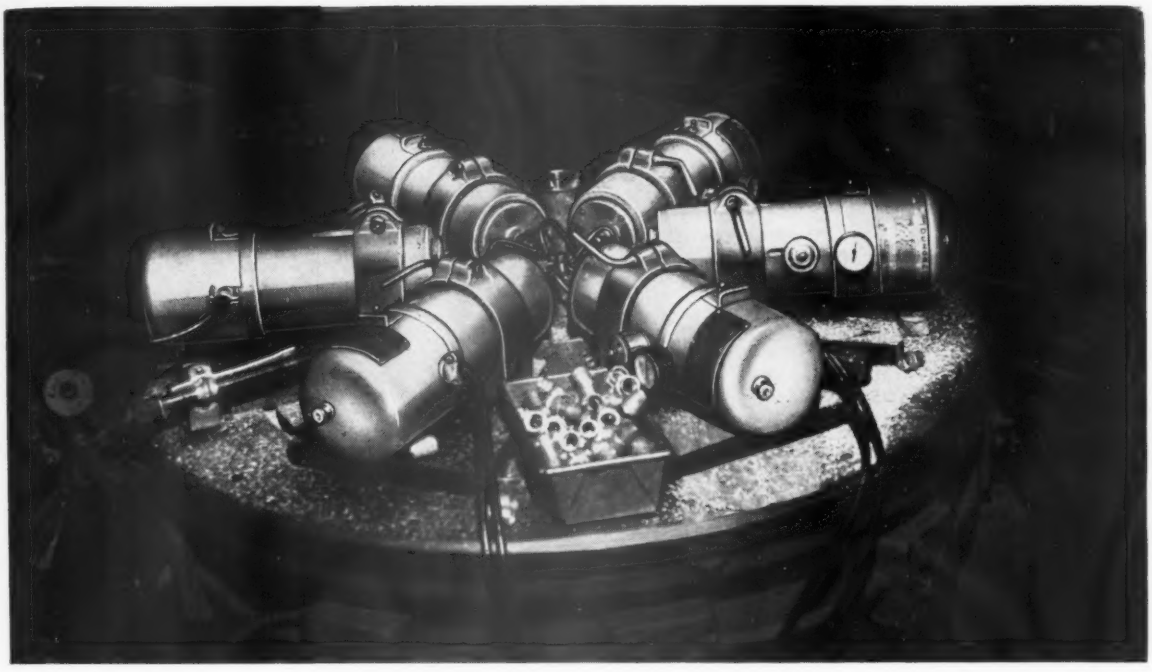
U. S. Burke Machine Tool Div., The 109
U. S. Diamond Wheel Co. 79
Universal Engineering Co. 13

Viking Tool & Machine Corp., The 138
V. O. Press Co., The 14
Vulcan Tool Co. 143

Wales-Strippit Corp. 20
Walls Sales Corp. 170
Walton Co., The 155
Ward Machinery Co. 171
Wardwell Mfg. Co., The 144
Watts Bros. Tool Works 145
Webber Gage Co. 28
Weckesser Co. 144
Weldon Tool Co., The 145
Wells Mfg. Corp. 156
Wesson Company 40
Wessonmetal Corp. 40
Wheel Trueing Tool Co. 2
Wheelock, Lovejoy & Co., Inc. 158
Whistler & Sons, Inc., S. B. 129
Whitney Metal Tool Co. 137

Yost Mfg. Co. 166

Zagar Tool, Inc. 64
Ze-Hawk Machine Specialties 168



Tooling simplified, output up, drill costs down...

with exceptionally versatile Dumore Automatic Drill Heads

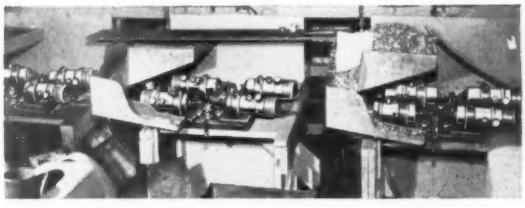
HERE'S the story of another successful investment in Dumore Precision Tools. To mass-produce a variety of small holes in connector plugs, Cannon Electric Mfg. Co. of Los Angeles bought 16 Automatic Drill Heads.

Today, these Drill Heads are being used in multiple-head setups of four, six or eight heads per unit.

How efficient are they?

In one six-head, radially-mounted setup, production was upped 100%. On another job where all 16 heads were set up in four-head units, production was tripled. Speaking of the Dumores, Cannon's chief production engineer says, "We're very pleased. They've increased production, cut drill breakage and simplified our tooling."

If you're interested in obtaining similar all-around production, cost and tooling benefits — get in touch with your Industrial Distributor or write:



ABOUT THE PICTURES ABOVE

TOP PHOTO — PRODUCTION UP 100%

This operation involves drilling 0.1285" through holes to a maximum of 3/16" in die-cast aluminum connector plug. Previous production, 200 pieces per hour — with Dumore's it's up to 600. Note simplicity of setup due to fact Dumores need no outside air or hydraulic supply, merely plug in electric outlet. When production requires, two more Dumores are quickly, easily added to setup.

BOTTOM PHOTO — OUTPUT TRIPLED

Here are the Cannon Electric Mfg. Co.'s Dumores mounted in setups of four heads each. They're producing No. 49 to No. 18 holes to a depth of 3/16". In an hour, the Dumores complete 750 of the die-cast aluminum alloy parts compared to 250 previously.

® DUMORE PRECISION TOOLS

DUMORE PRECISION TOOLS

THE DUMORE COMPANY

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BENCO

PUSHERS

You get smoother, faster feeding and less stock waste when you use Benco Pushers and Feed Fingers. Their exclusive design, precise heat-treating of oil-hardened tool steel and rigid inspection combine to assure accurate tension and long, trouble-free operation.

Benco makes the most complete line of Feed Fingers and Master Pushers; each provides the maximum production economies when properly used . . . regardless of the type or shape of stock or the machines you operate.

If you have a difficult feeding job involving long feed-outs, high speeds or scratchless production, let us recommend the right Benco Pusher to give you the best possible production at the lowest cost. You'll always get better results if you standardize on Benco.

BENCO also makes
- Master Pushers and Pads
- Pushers and Feed Fingers
- Master Collets and Pads
- Collet Sleeves and Chuck Nuts for B&S Machines
- Carbide Faced Stock Stops for B&S Machines
- Ejector Collets

BENCO COLLET MANUFACTURING CO.

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